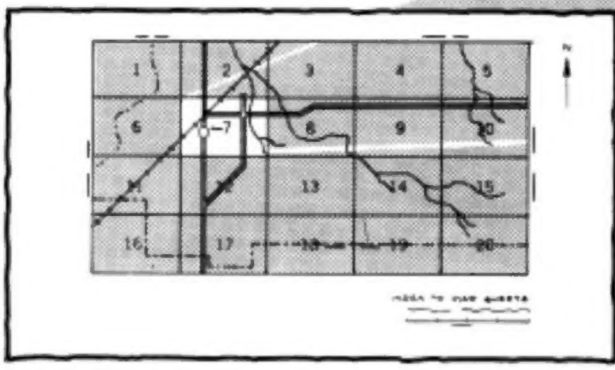
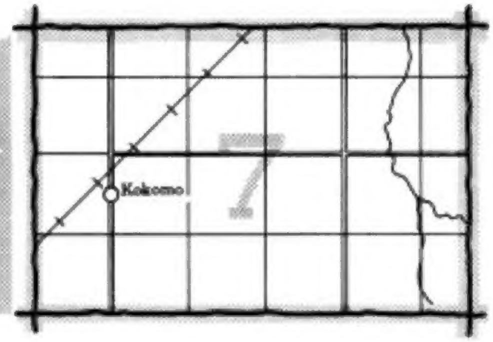
SOIL SURVEY OF
EMMONS COUNTY
NORTH DAKOTA

United States Department of Agriculture
Soil Conservation Service
in cooperation with
North Dakota Agricultural Experiment Station

HOW TO USE

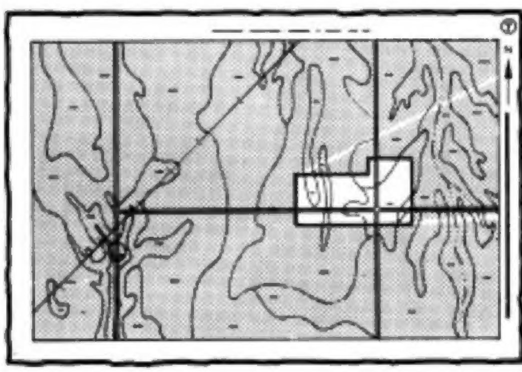
1. Locate your area of interest on the "Index to Map Sheets"

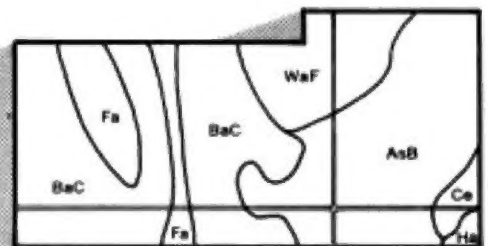




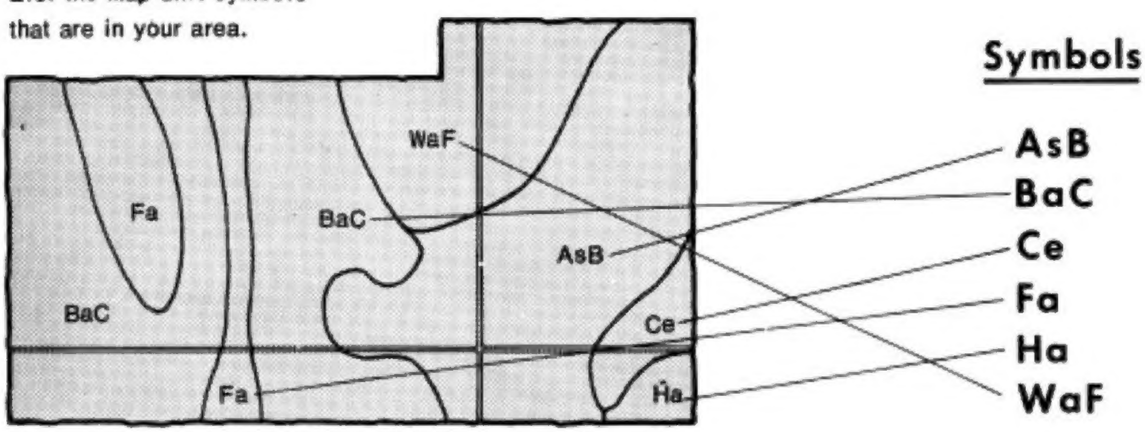
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



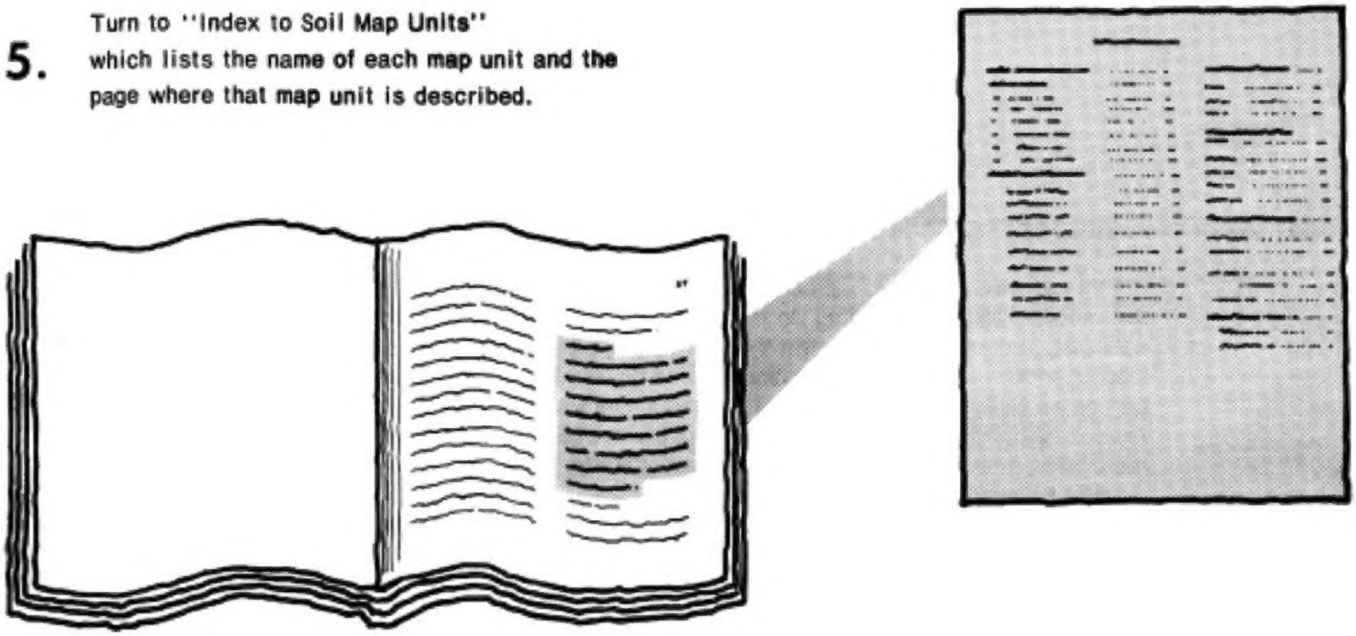


4. List the map unit symbols that are in your area.

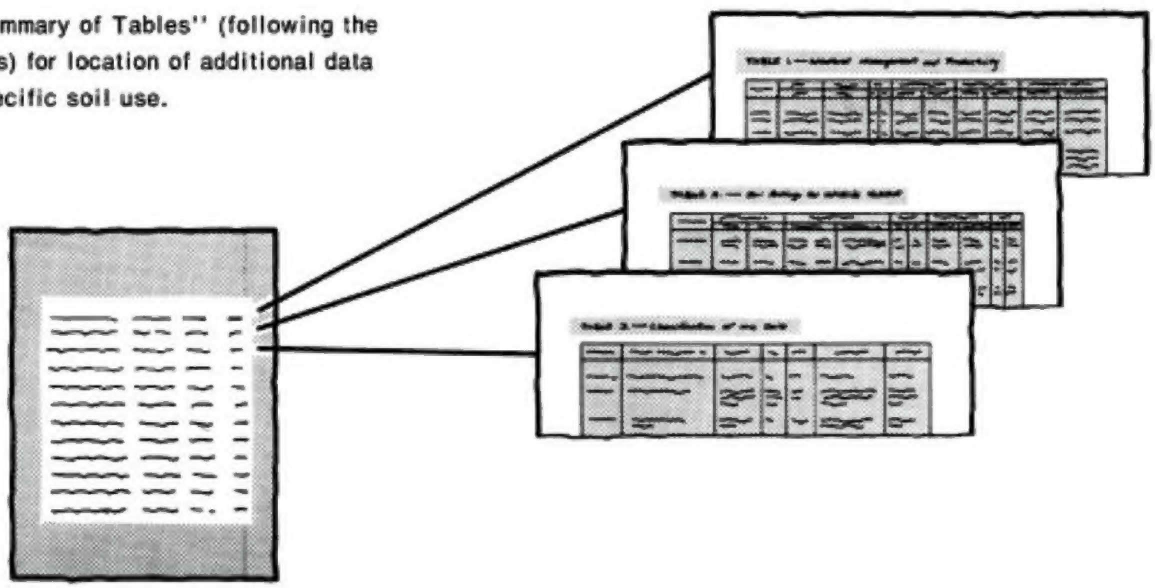


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the North Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Emmons County Soil Conservation District. Financial assistance was provided by the Emmons County Board of Commissioners and by the Old West Regional Commission through the North Dakota State Soil Conservation Committee. Major fieldwork was performed in the period 1974-1978. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979.

Cover: Omio and Temvik soils are on the convex slopes in the foreground. Grassna soils are in the swales. Amor, Bryant, Cabba, and Omio soils are in the background.

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Issued September 1980

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Foreword

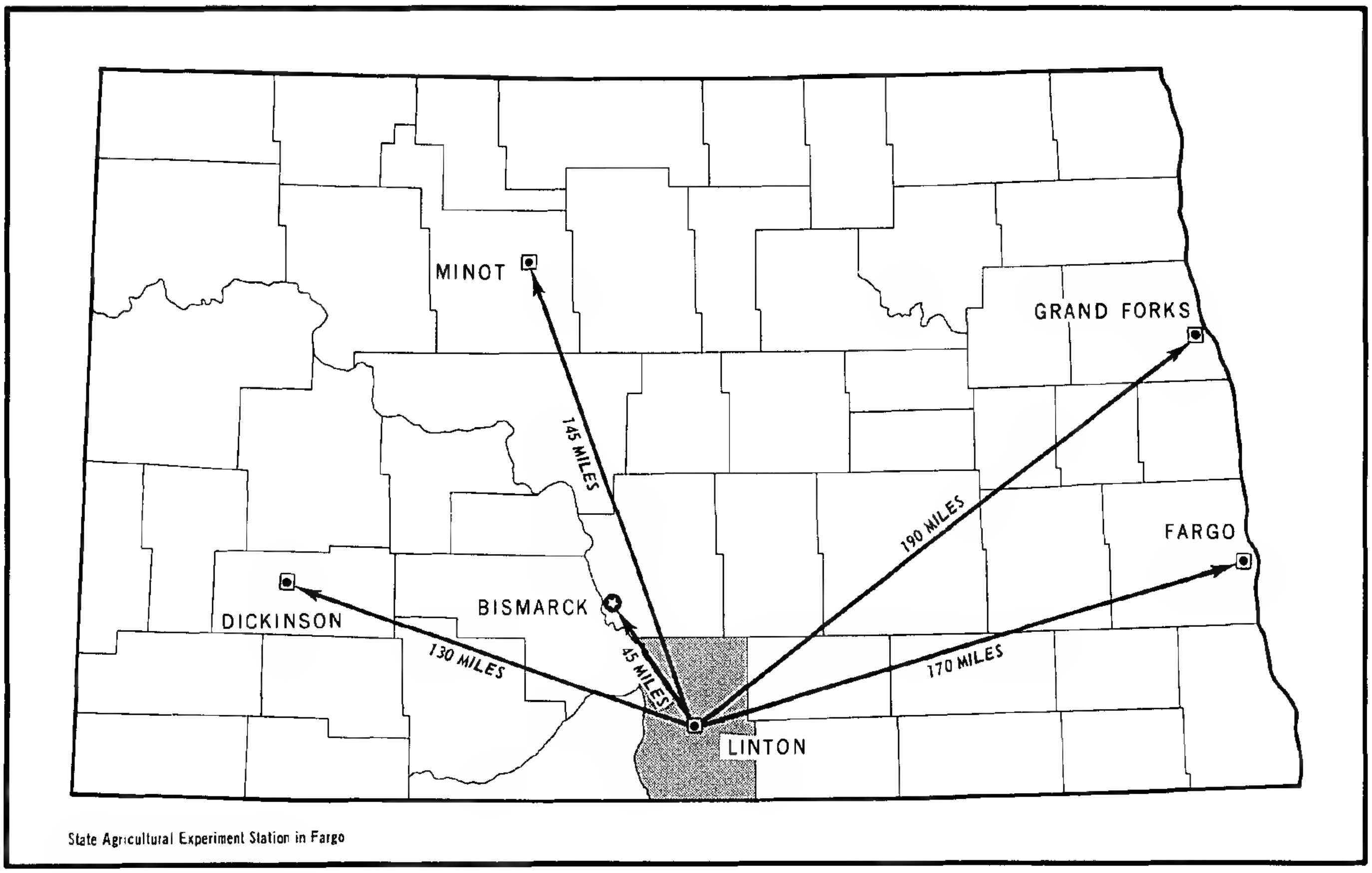
This soil survey contains information that can be used in land-planning programs in Emmons County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Allen L. Fisk
State Conservationist
Soil Conservation Service



Location of Emmons County in North Dakota.

SOIL SURVEY OF EMMONS COUNTY, NORTH DAKOTA

By David V. Wroblewski and Nordan J. Lunde, Soil Conservation Service

Fieldwork by David V. Wroblewski, Lester C. Brockmann, Nordan J. Lunde
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United States Department of Agriculture, Soil Conservation Service
in cooperation with North Dakota Agricultural Experiment Station

EMMONS COUNTY is in the south-central part of North Dakota. It is bordered on the south by South Dakota and on the west by the Missouri River.

The county was organized in 1883. Many of the early settlers immigrated directly from Germany, Holland, and Russia. Norwegians and Swedes settled in the northeastern part of the county.

According to the 1970 census, the population of Emmons County is 8,462. Linton, the county seat, has a population of 1,700. Other towns in the county are Braddock, Hague, Hazelton, Kintyre, Strasburg, Temvik, and Westfield.

U.S. Highway 83, the chief highway, extends north and south through the center of the county. North Dakota Highways 11, 13, and 34, which are hard-surfaced roads, run east from U.S. Highway 83. North Dakota Highway 1804, bordering the eastern edge of the Missouri River, marks the Lewis and Clark trail. A well developed system of gravelled and graded roads, commonly along section lines, is used for carrying farm products to market.

Livestock and cash grain farming make up the largest part of the economy of the county. There are a few large beef enterprises and numerous small ones. Most of the farm products are sold to local markets. The dairy industry markets most of its products to local processors or to firms in neighboring counties.

About 50 percent of the acreage is suitable for cultivation, and 2 percent is suitable for limited cropping. Hard red spring wheat, durum wheat, oats, barley, flax, corn, and alfalfa are common dryland crops. Corn, alfalfa, and small grain are common irrigated crops. Most of the irrigated acreage is on the flood plains or adjacent terraces along the Missouri River. Irrigation water for areas along the Missouri River is pumped from the Oahe Reservoir. In other irrigated areas, water is supplied by small dams and irrigation wells.

The native vegetation in Emmons County is mainly grasses, sedges, and forbs. The chief grasses in the uplands are green needlegrass, western wheatgrass, little bluestem, and needleandthread. Alkaligrass and saltgrass grow on the alkaline and saline soils. Prairie sandreed and sand dropseed are dominant on the sandy soils. Rivergrass, switchgrass, prairie cordgrass, rushes, and cattails grow on the wet soils.

Native shrubs and trees are common on much of the bottom land along creeks and rivers and in some ravines. The native trees are willow, cottonwood, ash, elm, bur oak, and boxelder. The native shrubs are plum, chokecherry, juneberry, and buffaloberry.

This survey updates part of the soil survey of western North Dakota that was published in 1908 (*4*). It provides additional information and larger maps that show the soils in greater detail.

General nature of the county

This section gives general information about the county. It describes the climate, the physiography, the relief and drainage, and the natural resources.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Linton, North Dakota, in the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 13 degrees F, and the average daily minimum temperature is 2 degrees. The lowest temperature on record, which occurred at Linton on January 18, 1970, is minus 44 degrees. In summer the average temperature is 69 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 12, 1973, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 17.3 inches. Of this, 14 inches, or 82 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 4.42 inches at Linton on June 6, 1956. Thunderstorms occur on about 35 days each year, and most occur in summer. During summer thunderstorms, hail falls in small scattered areas.

Average seasonal snowfall is 34 inches. The greatest snow depth at any one time during the period of record

was 48 inches. On an average, 48 days have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the west-northwest. Average windspeed is highest, 13 miles per hour, in April.

Physiography, relief, and drainage

Emmons County is on the Missouri Plateau in the Great Plains Province, which is a major subdivision of the Interior Plains. It is on the Coteau Slope, which is the glaciated section of the Missouri Plateau.

Short, irregular slopes characterize the areas of glacial deposits in the northeastern and southeastern parts of the county. Extensive areas where bedrock crops out and small areas where glacial deposits are thin characterize the western part of the county. In many areas severe geologic erosion has resulted in prominent buttes and badland. The highest point in the county is 585 feet above the Missouri River, which is 1,608 feet above sea level. The average relief is about 200 to 300 feet above the Missouri River.

Loess, a wind deposited sediment that is commonly unstratified and unconsolidated and is made up dominantly of silt-size particles, covers parts of Emmons County. The deposits are thickest in the western part of the county, adjacent to the Missouri River. They thin out gradually to the east. The loess mantle ranges from about 12 feet thick near the river to less than 1 foot thick near the eastern border. The shores, mud bars, and flood plains along the river are the chief sources of the loess.

Most of Emmons County is rolling to hilly. Areas adjacent to the Missouri River are dissected by a highly developed dendritic drainage pattern. Almost all of the surface water in the county drains into the Missouri River, except for that in small depressions, potholes, or lakes, mostly in the southeastern and extreme northeastern parts of the county. Five major integrated drainage systems drain the county. From north to south, they are Badger Creek, Horsehead Creek, Beaver Creek, Little Beaver Creek, and Cattail Creek. The drainage patterns were formed during and after the last glacial period.

Natural resources

The principal natural resources in the county are the large acreage of good quality farmland and the large amount of good quality water in the Oahe Resevior, which can be used for irrigation. Another natural resource is a bed of whitish, fine-grained volcanic ash, which is within the Fox Hills Sandstone Formation. The bed crops out in several places near Linton. The volcanic ash has been mined and used as road-construction material and processed as cat litter. Presently, it is mined for construction material.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows the soil associations in this survey area. Each

association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Shallow and moderately deep, nearly level to very steep soils on uplands

These soils formed in material weathered from bedrock. They make up about 31 percent of the county.

1. Amor-Vebar association

Moderately deep, nearly level to strongly sloping, well drained, medium textured and moderately coarse textured soils formed in material weathered from sandstone, siltstone, and shale

This association is on dissected residual uplands that are slightly higher than the surrounding areas. It makes up about 18 percent of the county. It is about 30 percent Amor soils, 25 percent Vebar soils, and 45 percent soils of minor extent.

The Amor and Vebar soils occupy similar landscape positions. The Amor soils are underlain by siltstone and the Vebar soils by sandstone. Typically, the Amor soils have a loam surface layer and the Vebar soils a fine sandy loam surface layer.

The minor soils in this association are the deep Arnegard and Williams soils, the shallow Cabba, Cohagen, and Flasher soils, and the moderately deep Reeder soils. The Arnegard soils are in swales, the Williams and Reeder soils are in positions similar to those of Amor soils, and the Cabba, Cohagen, and Flasher soils are on knobs and the crest of hills.

This association is used mainly for range. Some areas, generally the less sloping ones, are used for cultivated crops. The hazards of water erosion and soil blowing and the depth to bedrock are the main concerns if the major soils are farmed. The depth to bedrock is the main limitation affecting most other uses.

This association has fair potential for cultivated crops. The potential is good for range and fair for residential and other urban uses.

2. Vebar-Cohagen-Flasher association

Moderately deep and shallow, nearly level to strongly sloping, well drained and somewhat excessively drained, moderately coarse textured and coarse textured soils formed in material weathered from sandstone and shale

This association is on dissected residual uplands. It makes up about 3 percent of the county. It is about 35 percent Vebar soils, 20 percent Cohagen soils, 20 percent Flasher soils, and 25 percent soils of minor extent.

The Vebar soils are on the mid and lower slopes. The Cohagen and Flasher soils are in the higher positions. The Vebar and Cohagen soils are well drained and the Flasher soils somewhat excessively drained. Typically, the Vebar and Cohagen soils have a fine sandy loam surface layer and the Flasher soils a loamy fine sand surface layer.

The minor soils in this association are the deep Arnegard, Lihen, Parshall, and Telfer soils and the moderately deep Amor soils. The Arnegard and Parshall soils are in swales, the Lihen and Telfer soils are on foot slopes, and the Amor soils are in positions similar to those of the Vebar soils.

Most of the nearly level and undulating areas of this association are cropped. The steeper areas are used for range or hay. The minor Arnegard, Parshall, Lihen, and Amor soils are used mainly as cropland and the Telfer soils mainly as grassland. The hazards of soil blowing and water erosion are the main concerns if the nearly level and undulating areas are farmed. Slope, droughtiness, and the depth to bedrock are the principal limitations affecting most other uses.

This association has poor potential for cultivated crops. The potential is good for range and fair for residential and other urban uses.

3. Cabba-Amor association

Shallow and moderately deep, hilly to very steep, well drained, medium textured soils formed in material weathered from siltstone, shale, and sandstone

This association is on dissected residual uplands. It makes up about 8 percent of the county. It is about 40 percent Cabba soils, 35 percent Amor soils, and 25 percent soils of minor extent.

The Cabba soils are in the higher positions on the landscape, and the Amor soils are on the mid and lower slopes. Typically, both have a loam surface layer.

The minor soils in this association are the deep Arnegard, Daglum, and Rhoades soils and the moderately deep Omio and Reeder soils. The Arnegard soils are in swales, the Daglum and Rhoades soils are on the mid and lower side slopes, the Omio soils are on divides between drainageways, and the Reeder soils are in positions similar to those of the Amor soils.

This association is used mainly for range. The slope and the depth to bedrock are the main limitations if the major soils are cropped. The depth to bedrock is the main limitation affecting most other uses.

This association has poor potential for cultivated crops. The potential is fair for range and poor for residential and other urban uses.

4. Reeder-Cabba association

Moderately deep and shallow, nearly level to steep, well drained, medium textured soils formed in material weathered from siltstone, shale, and sandstone

This association is on dissected residual uplands. It makes up about 2 percent of the county. It is about 55 percent Reeder soils, 10 percent Cabba soils, and 35 percent soils of minor extent.

The Reeder soils are on the mid and lower slopes, and the Cabba soils are on the upper slopes. Typically, both have a loam surface layer.

The minor soils in this association are the deep Daglum, Arnegard, and Grail soils and the moderately deep Amor soils. The Arnegard and Grail soils are in swales, the Daglum soils are on the mid and lower side slopes, and the Amor soils are in positions similar to those of the Reeder soils.

The nearly level to moderately sloping areas of Reeder soils are used mainly as cropland. The hilly areas of Reeder and Cabba soils are used mainly as range. The hazard of water erosion and the depth to bedrock are the main concerns if the soils are cropped. The slope and the depth to bedrock are the main limitations affecting most other uses.

This association has fair potential for cultivated crops. It has good potential for range and fair potential for residential and other urban uses.

Deep, level to moderately sloping, sodic soils on terraces and uplands and in upland drainageways

These soils formed in material weathered from shale and in alluvium. They make up about 5 percent of the county.

5. Rhoades-Daglum-Belfield association

Deep, nearly level to moderately sloping, moderately well drained and well drained, medium textured soils formed in material weathered from shale and in alluvium

This association is on terraces and the adjacent uplands (fig. 1). It makes up about 3 percent of the

Figure 1.—Rhoades and Daglum soils in the foreground; Cabba soils in the background. The foreground area is typical of the Rhoades-Daglum-Belfield association.

county. It is about 40 percent Rhoades soils, 35 percent Daglum soils, 10 percent Belfield soils, and 15 percent soils of minor extent.

The Rhoades and Daglum soils are moderately well drained, and the Belfield soils are well drained. Typically, all three have a silt loam surface layer.

The minor soils in this association are the moderately deep Amor and Reeder soils and the shallow Cabba soils. The Amor and Reeder soils are in positions similar to those of the Daglum soils, and the Cabba soils are on knobs and the crest of hills.

This association is used mainly for range. Some of the nearly level and gently sloping areas of Belfield and Daglum soils are cropland. Poor physical condition and the hazards of water erosion and soil blowing are the main concerns if the major soils are farmed. Poor physical condition is the main limitation affecting most other uses.

This association has poor potential for cultivated crops, for range, and for residential and other urban uses.

6. Harriet association

Deep, level, poorly drained, medium textured soils formed in alluvium

This association is in glacial melt water channels. It makes up about 2 percent of the county. It is about 55 percent Harriet soils and 45 percent soils of minor extent.

The Harriet soils are in concave and plane areas. Typically, they have a silt loam surface layer.

The minor soils in this association are Rhoades, Daglum, and Regan soils. The Rhoades and Daglum soils are moderately well drained and are on terraces. They have a claypan. The Regan soils are poorly drained and are in positions similar to those of the Harriet soils.

This association is used mainly for range. Poor physical condition and wetness are the main limitations if the Harriet soils are farmed. Wetness, salinity, and slow permeability are the main limitations affecting most other uses.

This association has poor potential for cultivated crops and fair potential for range. It has poor potential for residential and other urban uses.

Deep and moderately deep, nearly level to hilly soils on uplands

These soils formed dominantly in material weathered from bedrock and in loess and glacial till. They make up about 45 percent of the county.

7. Omio-Grassna association

Moderately deep and deep, nearly level to moderately sloping, well drained, medium textured soils formed in loess and in material weathered from sandstone, siltstone, and shale

This association is on dissected, loess-mantled residual uplands. It makes up about 7 percent of the county. It is about 45 percent Omio soils, 15 percent Grassna soils, and 40 percent soils of minor extent.

The Omio soils are on the higher parts of plane and convex slopes, and the Grassna soils are in broad swales. Typically, both have a silt loam surface layer.

The minor soils in this association are the deep Arnegard and Bryant soils and the moderately deep Amor and Vebar soils. The Arnegard soils are in swales, the Bryant soils are in positions similar to those of the Omio soils, and the Amor and Vebar soils are on knobs.

This association is used mainly as cropland. The hazards of water erosion and soil blowing and the depth to bedrock are the main concerns if the major soils are farmed. The depth to bedrock is the main limitation affecting most other uses.

This association has good potential for cultivated crops and for range. It has fair potential for residential and other urban uses.

8. Temvik-Wilton-Grassna association

Deep, nearly level to moderately sloping, well drained, medium textured soils formed in loess and glacial till

This association is on glacial till uplands mantled with silty material. It makes up about 7 percent of the county. It is about 50 percent Temvik soils, 30 percent Wilton soils, 5 percent Grassna soils, and 15 percent soils of minor extent (fig. 2).

The Temvik soils are on convex slopes, and the Wilton soils are on plane and concave slopes. The Grassna soils are in broad swales. The Temvik and Wilton soils are underlain by glacial till. Typically, all three soils have a silt loam surface layer.

The minor soils in this association are the deep Williams, Tonka, and Parnell soils and the moderately deep Amor soils. The poorly drained Tonka and very poorly drained Parnell soils are in depressions. The Williams and Amor soils are on slight knobs.

This association is used mainly as cropland. The hazards of water erosion and soil blowing are the main concerns in managing the major soils as cropland. The moderately slow permeability in the glacial till of the Temvik and Wilton soils is the main limitation affecting most other uses.

This association has good potential for cultivated crops and for range. It has fair potential for residential and other urban uses.

9. Bryant-Grassna association

Deep, nearly level to moderately sloping, well drained, medium textured soils formed in loess

This association is on uplands mantled with a deep layer of loess. It makes up about 9 percent of the county. It is about 45 percent Bryant soils, 25 percent Grassna soils, and 30 percent soils of minor extent (fig. 3).

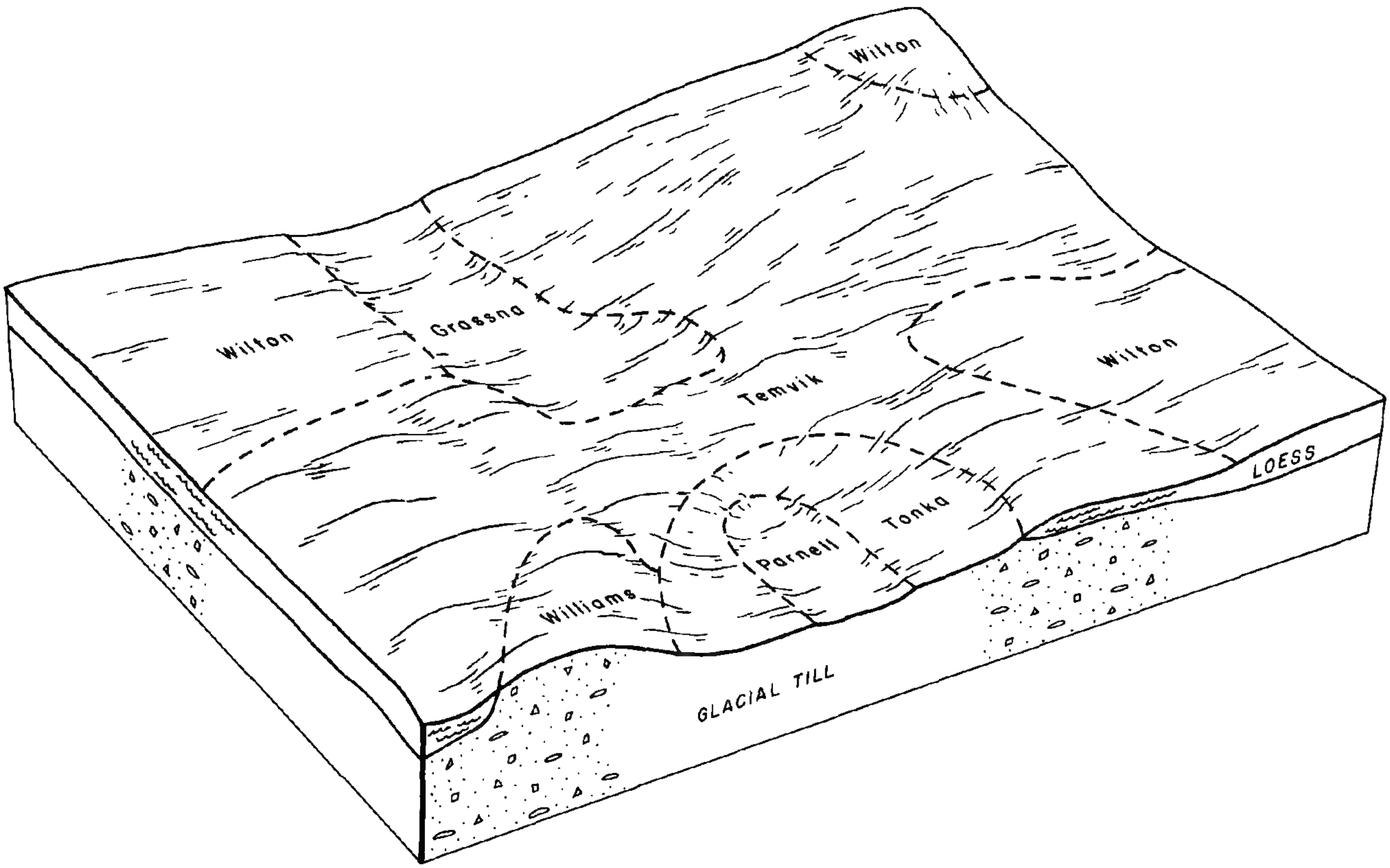

Figure 2.—Pattern of soils and parent material in the Temvik-Wilton-Grassna association.

The Bryant soils are in convex and plane areas, and the Grassna soils are in concave areas. Typically, both have a silt loam surface layer.

The minor soils in this association are the shallow Cabba soils, the moderately deep Omio soils, and the deep Williams, Temvik, Tonka, and Parnell soils. The well drained Omio and Temvik soils are in convex areas. The poorly drained Tonka and very poorly drained Parnell soils are in depressions. The Williams soils are on knobs, and the Cabba soils are on knobs and side slopes.

This association is used mainly as cropland. The hazards of soil blowing and water erosion are the main concerns if the major soils are farmed. Few limitations affect most other uses.

This association has good potential for cultivated crops, for range, and for residential and other urban uses.

10. Williams-Zahl association

Deep, nearly level to hilly, well drained, medium textured soils formed in glacial till

This association is on glacial till uplands. It makes up about 12 percent of the county. It is about 55 percent Williams soils, 8 percent Zahl soils, and 37 percent soils of minor extent (fig 4).

The Williams soils are on the convex parts of the mid and lower slopes, and the Zahl soils are on the convex parts of the upper slopes. Typically, both have a loam surface layer.

The minor soils in this association are the deep Arnegard, Bearpaw, Bowbells, Falkirk, Tonka, and Parnell soils. The well drained Bearpaw and Falkirk soils are in plane and convex areas. The Arnegard soils are in swales. The poorly drained Tonka and very poorly drained Parnell soils are in depressions. The Bowbells soils are in shallow swales.

This association is used mainly as cropland. The hazards of water erosion and soil blowing and the slope

are the main concerns if the major soils are farmed. Slope and moderately slow permeability are the main limitations affecting most other uses.

This association has good potential for cultivated crops and for range. It has fair potential for residential and other urban uses.

11. Bearpaw-Noonan association

Deep, nearly level to gently rolling, well drained, medium textured soils formed in glacial till

This association is on glacial till uplands. It makes up about 5 percent of the county. It is about 45 percent Bearpaw soils, 20 percent Noonan soils, and 35 percent soils of minor extent.

The Bearpaw soils are in convex and plane areas, and the Noonan soils are in slightly concave areas. Typically, the Bearpaw soils have a silt loam surface layer and the Noonan soils a loam surface layer.

The minor soils in this association are the deep Williams, Niobell, Tonka, and Parnell soils. The well drained Williams and Niobell soils are in plane and convex areas, and the poorly drained Tonka and very poorly drained Parnell soils are in depressions.

This association is used mainly as cropland. The hazards of water erosion and soil blowing are the main concerns if the major soils are farmed. Slow permeability is the main limitation affecting most other uses.

This association has good potential for cultivated crops and for range and fair potential for residential and other urban uses.

12. Williams-Falkirk association

Deep, nearly level and undulating, well drained, medium textured soils formed in glacial till and glaciofluvial material

This association is on glacial till uplands. It makes up about 5 percent of the county. It is about 55 percent Williams soils, 20 percent Falkirk soils, and 25 percent soils of minor extent.

The Williams soils are in convex areas, and the Falkirk soils are in plane and concave areas. Typically, both have a loam surface layer.

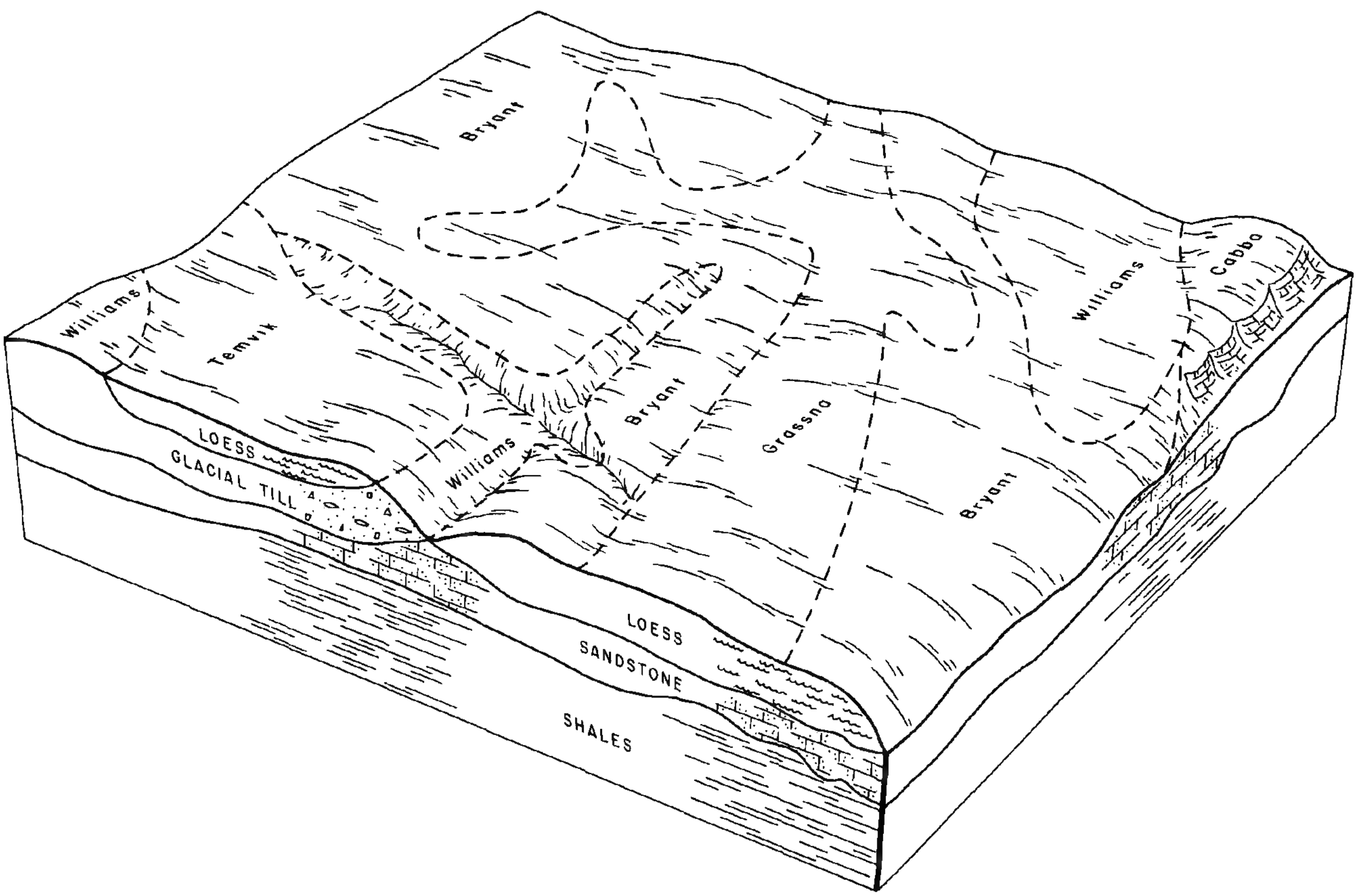

Figure 3.—Pattern of soils and parent material in the Bryant-Grassna association.

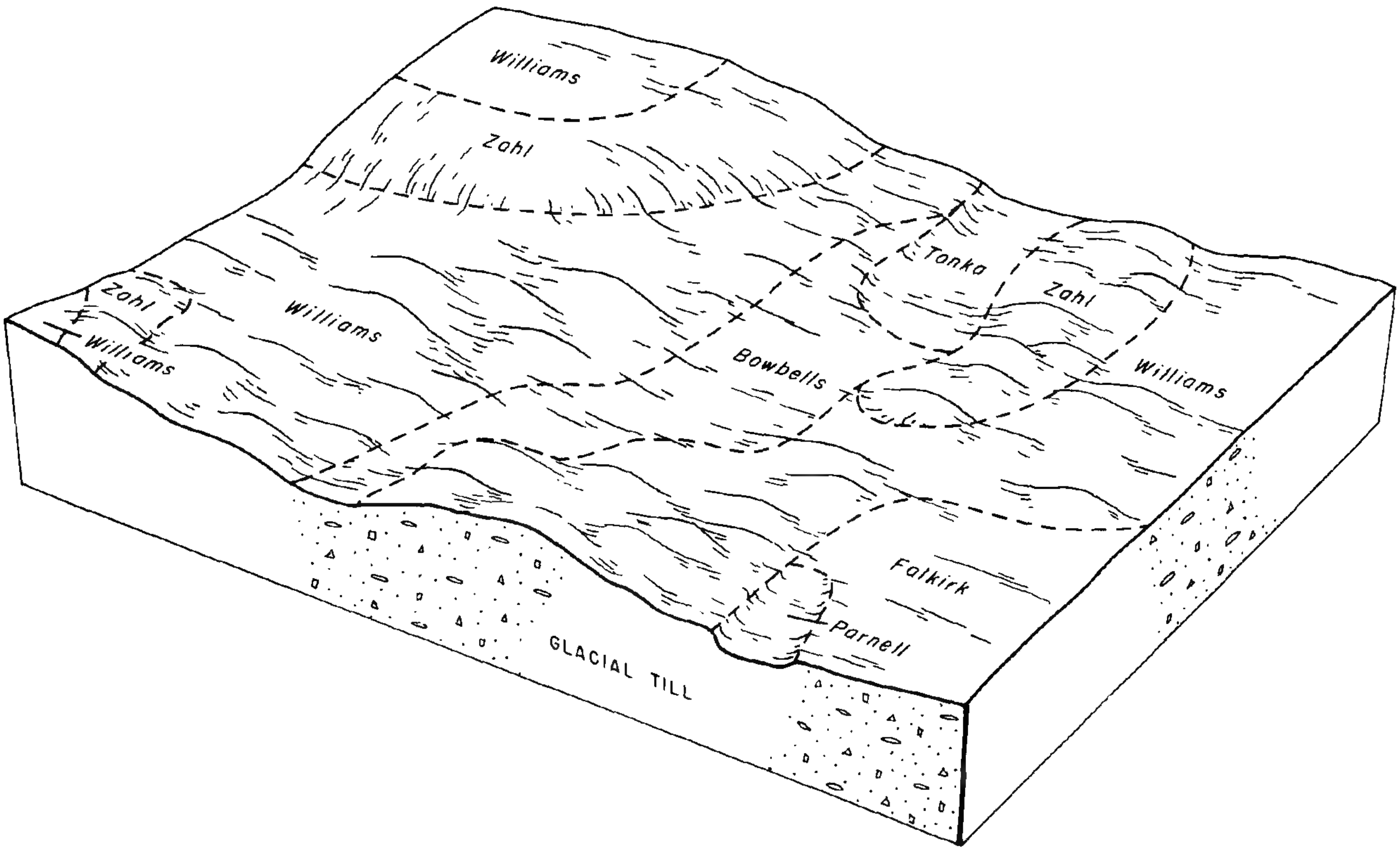

Figure 4.—Pattern of soils and parent material in the Williams-Zahl association.

The minor soils in this association are the deep Bearpaw, Arnegard, Shambo, Tonka, and Parnell soils. The well drained Bearpaw and Shambo soils are in plane and convex areas. The Arnegard soils are in swales. The poorly drained Tonka and very poorly drained Parnell soils are in depressions.

This association is used mainly as cropland. The hazards of soil blowing and water erosion are the main concerns if the major soils are farmed. The moderately slow permeability in the glacial till is the main limitation affecting most other uses.

This association has good potential for cultivated crops and for range and fair potential for residential and other urban uses.

Deep, nearly level soils on flood plains

These soils formed in alluvium. They make up about 2 percent of the county.

13. Straw association

Deep, nearly level, well drained, medium textured soils formed in alluvium

This association is on flood plains along streams. It makes up about 2 percent of the county. It is about 65 percent Straw soils and 35 percent soils of minor extent.

The Straw soils are in plane and concave areas on the flood plains. Typically, they have a silt loam surface layer.

The minor soils in this association are Shambo, Stady, Belfield, and Harriet soils. The well drained Shambo and Stady soils are on low terraces. The well drained Belfield soils are on terraces, and the poorly drained Harriet soils are on flood plains. Both have a sodic claypan.

This association is used mainly as cropland. Flooding on the Straw soils is the main hazard affecting farm uses and most other uses.

This association has good potential for cultivated crops and for range and poor potential for residential and other urban uses.

Deep, nearly level to rolling soils on uplands, terraces, and outwash plains

These soils formed in eolian deposits, alluvium, and glacial till. They make up about 17 percent of the county.

14. Flaxton-Krem association

Deep, nearly level to rolling, well drained, moderately coarse textured and coarse textured soils formed in eolian deposits and glacial till

This association is on glacial till uplands. It makes up about 2 percent of the county. It is about 55 percent Flaxton soils, 20 percent Krem soils, and 25 percent soils of minor extent.

The Flaxton soils formed in a moderately coarse textured mantle and in the underlying glacial till, and the Krem soils formed in a coarse textured mantle and in the underlying glacial till. Typically, the Flaxton soils have a fine sandy loam surface layer and the Krem soils a loamy fine sand surface layer.

The minor soils in this association are the deep Lihen, Parshall, and Williams soils. The Parshall soils are in swales, the Lihen soils are on side slopes, and the Williams soils are on knobs and the crest of low hills.

The nearly level and undulating areas are used mainly as cropland. The gently rolling and rolling areas are used mainly as range. The hazards of soil blowing and water erosion are the main concerns if the major soils are cropped. No serious limitations affect the use of the soils for range. The moderately slow permeability in the underlying till is the main limitation affecting most other uses.

This association has fair potential for cultivated crops. It has good potential for range and fair potential for residential and other urban uses.

15. Stady-Lehr association

Deep, nearly level to moderately sloping, well drained and somewhat excessively drained, medium textured soils formed in alluvium underlain by sand and gravel

This association is on glacial outwash plains and terraces. It makes up about 2 percent of the county. It is about 40 percent Stady soils, 35 percent Lehr soils, and 25 percent soils of minor extent.

The Stady and Lehr soils are in convex and plane areas. The Stady soils are well drained, and the Lehr soils are somewhat excessively drained. Typically, both have a loam surface layer. The depth to sand and gravel is 20 to 40 inches in the Stady soils and 14 to 20 inches in the Lehr soils.

The minor soils in this association are Wabek, Manning, and Arnegard soils. The Wabek soils are on knobs and the crest of low hills. The Manning soils are in positions similar to those of the Stady soils. The Arnegard soils are in swales.

This association is used mainly as cropland. Droughtiness and the hazards of soil blowing and water erosion are the main concerns if the major soils are farmed. Droughtiness and the very rapid permeability in the substratum are the main limitations affecting most other uses.

This association has poor potential for cultivated crops and fair potential for range. It has good potential for residential and most other urban uses.

16. Lihen-Parshall association

Deep, nearly level to moderately sloping, well drained, coarse textured and moderately coarse textured soils formed in eolian material and in alluvium

This association is on outwash terraces. It makes up about 13 percent of the county. It is about 40 percent Lihen soils, 20 percent Parshall soils, and 40 percent soils of minor extent (fig. 5).

The Lihen and Parshall soils are in plane and concave areas. The Lihen soils formed in eolian material and in alluvium, and the Parshall soils formed in alluvium. Typically, the Lihen soils have a fine sandy loam or loamy fine sand surface layer and the Parshall soils a fine sandy loam surface layer.

The minor soils in this association are Seroco, Flaxton, Arnegard, Banks Variant, Lallie, Havrelon Variant, and Shambo soils. The Banks Variant, Lallie, and Havrelon Variant soils are on flood plains. The Arnegard soils are in swales, the Shambo soils are on the lower side slopes, the Flaxton soils are on knobs and the crest of low hills, and the Seroco soils are on dunelike ridges.

The more sloping areas and the areas where the surface layer is loamy fine sand are used mainly as range. The less sloping areas and the areas where the surface layer is fine sandy loam are cropped. Droughtiness and the hazards of soil blowing and water erosion are the main concerns if the major soils are farmed. Rapid or moderately rapid permeability is the main limitation affecting most other uses.

This association has poor potential for cultivated crops and good potential for range and for residential and other urban uses.

Broad land use considerations

Deciding which soils should be used for urban and industrial development and which should be used as cropland and rangeland is becoming an increasingly important issue in the survey area. The general soil map is helpful in planning the general outline of urban and industrial areas. It cannot be used, however, for the selection of sites for specific urban and industrial structures. In general, the soils in the survey area that have good potential for cultivated crops also have good potential for urban and industrial development. The data about soils can be useful in planning future land use patterns in Emmons County.

According to the North Dakota Conservation Needs Inventory for 1970, the acreage of cropland increased from 48.2 percent of the total acreage in the county in 1958 to 64.6 percent in 1967. The acreage of rangeland decreased from 48.4 percent in 1958 to 32.6 percent in 1967, and the acreage of forest land decreased from 2.4

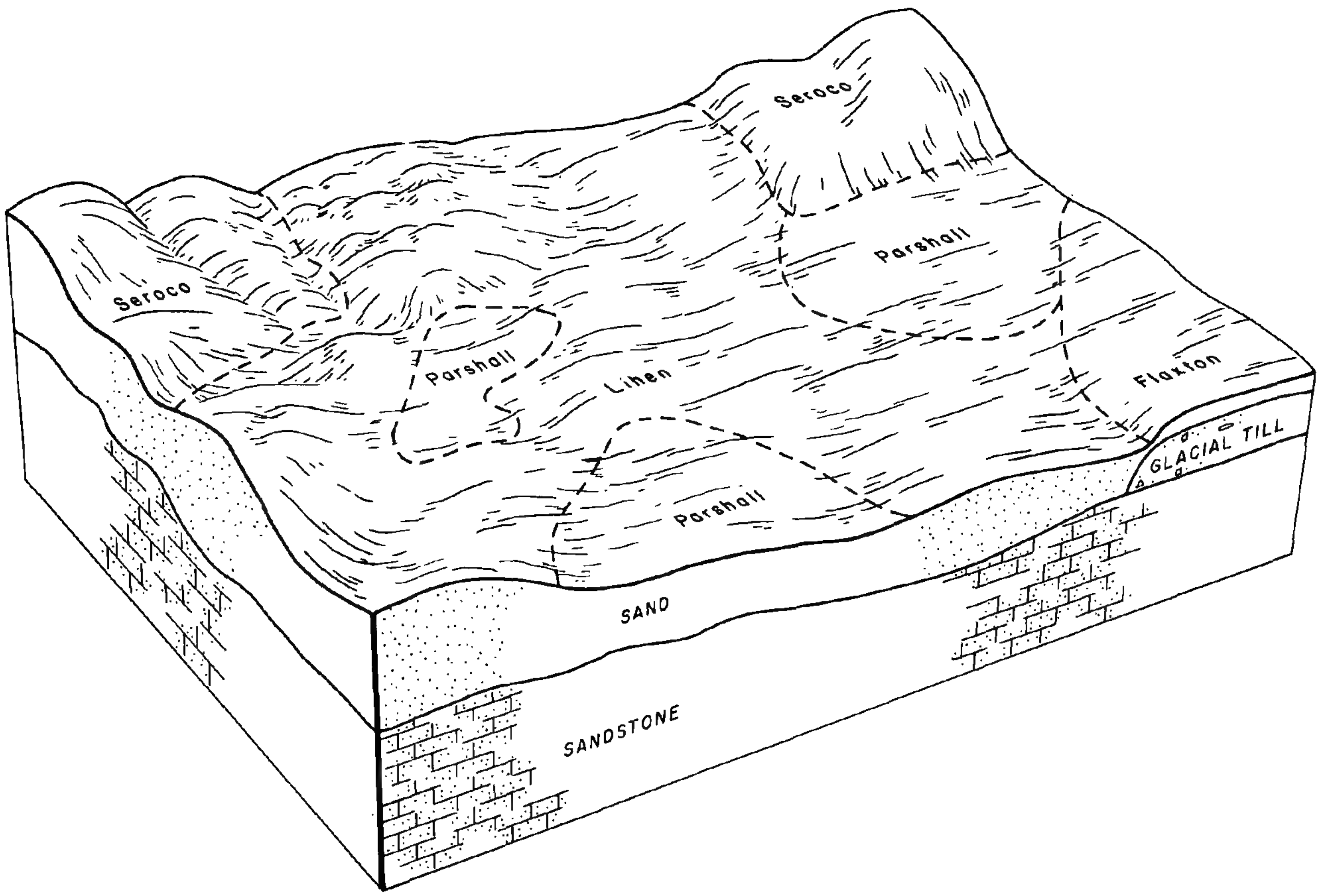

Figure 5.—Pattern of soils and parent material in the Lihen-Parshall association.

percent to 0.7 percent. According to the U.S. Census of Agriculture, the average size of farms increased from 712 acres in 1950 to 911 acres in 1974 and the number of farms decreased from 1,315 in 1950 to 951 in 1974.

The associations having the worst potential for urban and industrial development are the Harriet association, which is limited by wetness, ponding, and salinity; the Straw association, which is limited by stream overflow; the Rhoades-Daglum-Belfield association, which is limited by the sodic nature of the soils; and the Cabba-Amor association, which is limited by excessive slopes. The Bryant-Grassna, Lihen-Parshall, and Stady-Lehr associations have the best potential for urban and industrial development. The soils in these associations are deep and are not too steep. The Stady and Lehr soils, however, are underlain by very rapidly permeable sand and gravel. As a result, the effluent from onsite sewage disposal systems can contaminate ground water.

The associations least suitable for cultivated crops are the Vebar-Cohagen-Flasher and Cabba-Amor associations, which are limited by a restricted depth to bedrock, by droughtiness, and by excessive slope; the Rhoades-Daglum-Belfield association, which is limited by excess sodium, salinity, and a restricted root zone resulting from a claypan subsoil; the Stady-Lehr association, which is limited by a low available water capacity and by droughtiness; and the Harriet association, which is limited by wetness, ponding, salinity, and a claypan subsoil. The associations best suited to cultivated crops are the Omio-Grassna, Temvik-Wilton-Grassna, Bryant-Grassna, Williams-Zahl, Bearpaw-Noonan, Williams-Falkirk, and Straw associations. The Omio-Grassna, Temvik-Wilton-Grassna, and Bryant-Grassna associations are well suited to flax because of a low incidence of soil crusting and a resultant high emergence of flax seedlings.

The Rhoades-Daglum-Belfield association has the worst potential for range because of the poor physical condition of the claypan subsoil and the resultant poor plant growth. The Cabba-Amor, Stady-Lehr, and Harriet associations have only fair potential for range because of droughtiness, a shallow root zone, or salinity.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and specifies the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Williams loam, 6 to 9 percent slopes, is one of several phases in the Williams series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Daglum-Rhoades silt loams, 3 to 9 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimiliar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

3—Regan silt loam. This deep, level, poorly drained soil is in broad depressions in glacial till plains. It is commonly ponded after snowmelt and during periods of heavy rainfall. Individual areas range from about 15 to more than 100 acres in size.

Typically, the surface layer is dark gray silt loam about 12 inches thick. The upper part of the substratum is gray and light brownish gray silt loam. The lower part to a depth of about 60 inches is light gray loam.

Included with this soil in mapping are small areas of Arveson and Parnell soils. These soils are in the lowest part of the depressions. They make up about 5 to 10 percent of the unit. Arveson soils contain less silt and more sand and Parnell soils more clay and less silt than the Regan soil.

Permeability is moderately slow in the Regan soil, and surface runoff is very slow. A seasonal high water table is evident following snowmelt and after periods of heavy rainfall. Available water capacity is high. Organic matter content is moderate.

Most areas are hayland or pastureland. The potential is fair for cultivated crops and for windbreaks, good for range, and poor for sanitary facilities and dwellings.

If drained, this soil is suited to wheat, oats, barley, flax, and grasses and legumes. Few areas, however, are drained. Drainage outlets generally are not available. In the undrained areas wetness delays or prevents tillage and seeding in most years. The hazards of soil blowing and water erosion are slight. Stubble mulching helps to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Proper stocking rates, uniform distribution of grazing, and deferred grazing while the soil is wet help to keep the pasture or range and the soil in good condition.

If drained, this soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established. Undrained areas are generally unsuitable as sites for windbreaks.

This soil is poorly suited to sanitary facilities and dwellings because of the high water table and the flooding. The measures needed to overcome these limitations are costly. In this survey area Regan soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is IVw.

6B—Niobell loam, 1 to 6 percent slopes. This deep, nearly level and undulating, well drained, alkali soil is on foot slopes and in swales on uplands. Individual areas range from about 15 to 80 acres in size and are linear in shape.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is loam about 13 inches thick. It is dark brown in the upper part and light olive brown in the lower part. The substratum to a depth of about 60 inches is clay loam. It is light olive gray in the upper part and pale olive in the lower part. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Bearpaw, Falkirk, Noonan, and Williams soils. These soils make up about 15 percent of the unit. The Bearpaw, Falkirk, and Williams soils do not have an alkali subsoil. The alkali subsoil of the Noonan soils affects plants more adversely than that of the Niobell soil. The Bearpaw and Williams soils are on slight rises, and the Falkirk and Noonan soils are in the same positions as the Niobell soil.

Permeability is slow in the Niobell soil, and surface runoff is medium. Available water capacity is high. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion, however, are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss. Growing alfalfa and managing crop residue increase the infiltration rate and improve tilth. The depth to which roots can penetrate is restricted by the alkali subsoil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing, deferred grazing in the spring, and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Some of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The slow permeability is a limitation in septic tank absorption fields, but enlarging the field helps to overcome this limitation. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

8—Heil silt loam. This deep, level, poorly drained, alkali soil is in shallow depressions in the uplands. It is frequently ponded after snowmelt and during periods of heavy rainfall. Individual areas range from about 5 to more than 150 acres in size and generally are circular or linear.

Typically, the surface layer is dark gray silt loam about 3 inches thick. The subsoil is clay about 32 inches thick. It is dark gray in the upper part and gray in the lower part. The substratum to a depth of about 60 inches is clay. It is gray in the upper part, light olive gray in the middle part, and pale yellow in the lower part.

Included with this soil in mapping are small areas of Parnell soils in the lowest part of the depressions. These soils do not have an alkali subsoil. They make up about 5 to 10 percent of the unit.

Permeability is very slow in the Heil soil, and surface runoff is slow. A seasonal high water table is evident following snowmelt and after periods of heavy rainfall. Available water capacity is high. Organic matter content is moderate.

Most areas are used for range or hay. The potential is poor for cultivated crops and for windbreaks and environmental plantings, sanitary facilities, and dwellings and good for range.

This soil is generally unsuited to cultivated crops. The alkali subsoil and the wetness are the main limitations if cultivated crops are grown. The hazards of soil blowing and water erosion are slight.

A cover of range or pasture plants or of hay keeps this soil in good condition. Uniform distribution of grazing, deferred grazing while the soil is wet, and proper stocking rates help to keep the pasture or range in good condition.

This soil is poorly suited to sanitary facilities and dwellings because of the high water table, the ponding, and the very slow permeability. The measures needed to overcome these limitations are costly. In this survey area Heil soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is VIs.

9—Tonka silt loam. This deep, level, poorly drained soil is in shallow depressions in the uplands. It is commonly ponded during snowmelt and during periods of heavy rainfall. Individual areas range from about 5 to 50 acres in size and generally are circular or linear.

Typically, the surface layer is dark gray silt loam about 6 inches thick. The subsurface layer is light brownish gray silt loam about 12 inches thick. The subsoil is grayish brown silty clay loam about 21 inches thick. The substratum to a depth of about 60 inches is olive gray silty clay loam.

Included with this soil in mapping are small areas of Parnell soils in the lowest part of the depressions. These soils make up about 5 to 10 percent of the unit.

Permeability is slow in the Tonka soil, and surface runoff is ponded. A seasonal high water table is evident following snowmelt and after periods of heavy rainfall. Available water capacity is high. Organic matter content also is high.

Most areas are hayland or wetland wildlife habitat. The potential is good for cultivated crops and for range and windbreaks and poor for sanitary facilities and dwellings.

If drained, this soil is suited to wheat, oats, barley, flax, grasses, and legumes. Few areas, however, are drained. Suitable drainage outlets generally are not available. In the undrained areas, wetness delays or prevents tillage and seeding in most years. The hazard of water erosion is slight, and the hazard of soil blowing is moderate. Stubble mulching helps to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing, deferred grazing while the soil is wet, and proper stocking rates help to keep the pasture or range and the soil in good condition.

If drained, this soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established. Undrained areas are generally unsuited to windbreaks.

This soil is poorly suited to sanitary facilities and dwellings because of the high water table, the ponding, and the slow permeability. The measures needed to overcome these limitations are costly. In this survey area Tonka soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is IVw.

10—Parnell silt loam. This deep, level, very poorly drained soil is in depressions in the uplands. It is frequently ponded during snowmelt and during periods of heavy rainfall. Individual areas range from 5 to more than 80 acres in size and are generally circular or linear.

Typically, the surface layer is about 9 inches thick. It is very dark gray silt loam in the upper part and dark gray silty clay loam in the lower part. The subsoil is about 51 inches thick. It is dark gray silty clay loam in the upper part, dark gray and gray silty clay in the middle part, and gray clay loam in the lower part. In some areas the upper part of the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Tonka soils on slight rises in the depressions. These soils make up 5 to 15 percent of the unit.

Permeability is slow in the Parnell soil, and surface runoff is very slow. A seasonal high water table is evident following snowmelt and after periods of heavy rainfall. Available water capacity is high. Organic matter content also is high.

Most areas are hayland or wetland wildlife habitat. The potential is good for cultivated crops and for range and windbreaks and poor for sanitary facilities and dwellings.

If drained, this soil is suited to wheat, oats, barley, flax, grasses, and legumes. Few areas, however, are drained. Suitable drainage outlets generally are not available. In the undrained areas wetness delays tillage and seeding in most years. The hazards of soil blowing and water erosion are slight.

This soil is suited to pasture, range, and hay. Uniform distribution of grazing, deferred grazing while the soil is wet, and proper stocking rates help to keep the pasture or range and the soil in good condition.

Unless drained, this soil is generally unsuited to the trees and shrubs grown as windbreaks and environmental plantings. If the soil is drained, however, all climatically adapted species can grow well.

This soil is poorly suited to sanitary facilities and dwellings because of the high water table, the ponding, and the slow permeability. The measures needed to overcome these limitations are costly. In this survey area Parnell soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is Vw.

11—Straw silt loam, channeled. This deep, nearly level, well drained soil is on flood plains dissected by abandoned stream channels. It is subject to flooding. Individual areas range from about 30 to more than 150 acres in size and are linear in shape.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 16 inches thick. The substratum to a depth of about 60 inches is silt loam. It is light brownish gray in the upper part and grayish brown in the lower part. In places the soil contains less silt and more sand.

Included with this soil in mapping are small areas of Shambo, Stady, and Lehr soils on the convex parts of the landscape. The Lehr soils are 14 to 20 inches deep over sand and gravel, and the Stady soils are 20 to 40 inches deep over sand and gravel. The Shambo soils are dark to a depth of less than 16 inches. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Straw soil, and surface runoff is slow. Available water capacity is high. Organic matter content also is high.

Most areas are used for range or pasture. The potential is good for range and windbreaks and poor for cultivated crops and for sanitary facilities and dwellings.

This soil is generally unsuited to cultivated crops. Only a very small acreage is cropland or hayland because farm machinery generally cannot cross the short slopes along the abandoned stream channels.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is poorly suited to sanitary facilities and dwellings because it is subject to flooding. The measures needed to overcome the flood hazard are costly. In this survey area Straw soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is VIw.

12—Neche Variant loam. This deep, level, very poorly drained soil is along streams and drainageways. It is frequently flooded during snowmelt and after periods of heavy rainfall. Individual areas range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The upper part of the substratum is grayish brown silt loam. The lower part to a depth of about 60 inches is olive loam. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Regan and Parnell soils, which make up 5 to 15 percent of the unit. These soils are finer textured than the Neche soil. The Parnell soils are in the same position on the landscape as the Neche soil, and the Regan soils are on slight rises and convex slopes.

Permeability is moderate in the Neche soil, and surface runoff is very slow. Available water capacity is high. The soil has a seasonal high water table. Organic matter content is high.

Most areas are used for range. The potential is poor for cultivated crops and for windbreaks and environmental plantings, sanitary facilities, and dwellings and good for range.

This soil is generally unsuited to cultivated crops because it is wet and subject to flooding. It is well suited to pasture, range, and hay. Uniform distribution of grazing, deferred grazing while the soil is wet, and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is poorly suited to sanitary facilities and dwellings because of the high water table and the flooding. The measures needed to overcome these limitations are costly. In this survey area Neche soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is VIw.

13—Arnegard loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is in upland swales and on terraces, valley fans, and foot slopes (fig. 6). The surface is plane and concave. Individual areas range from about 10 to 80 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown loam about 15 inches thick. The subsoil is loam about 27 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is grayish brown loam. In some places the surface layer is silt loam. In other places the dark colors extend to a depth of less than 16 inches. In some areas soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Vebar soils on convex slopes. These soils are 20 to 40 inches deep over soft bedrock and have a surface layer of fine sandy loam. They make up about 5 percent of this unit.

Permeability is moderate in the Arnegard soil, and surface runoff is slow. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. Low strength is a limitation on sites for dwellings, but it can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIc.

13B—Arnegard loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is in upland swales and on terraces, valley fans, and foot slopes. The surface is plane and concave. Individual areas range from about 10 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown loam about 15 inches thick. The subsoil is loam about 27 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is grayish brown loam. In some areas soft bedrock is at a depth of 30 to 60 inches. In other areas the dark colors extend to a depth of less than 16 inches.

Included with this soil in mapping are small areas of Vebar soils on convex slopes. These soils are 20 to 40 inches deep over soft bedrock and have a surface layer of fine sandy loam. They make up about 5 to 10 percent of the unit.

Figure 6.—An area of Arnegard loam, 1 to 3 percent slopes, in upland swales. Amor and Cabba soils are in the background.

Permeability is moderate in the Arnegard soil, and surface runoff is medium. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and contour stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. Low strength is a limitation on sites for dwellings, but it can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIe.

15D—Cabba-Amor loams, 9 to 15 percent slopes. These are shallow and moderately deep, strongly sloping, well drained soils on upland benches and divides. Individual areas range from about 40 to several hundred acres in size. They are about 45 to 55 percent Cabba soil and 25 to 35 percent Amor soil. The Cabba soil is on ridgetops and the upper side slopes, in areas dissected by well defined drainageways. The Amor soil is on the plane and slightly concave mid and lower side slopes and on foot slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Cabba soil has a surface layer of grayish brown loam about 4 inches thick. The next 6 inches is grayish brown loam. The substratum, to a depth of about 19 inches, is pale yellow clay loam. Below this to a depth of about 60 inches is soft bedrock. In places the soft bedrock is within a depth of 8 inches.

Typically, the Amor soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is

grayish brown loam about 13 inches thick. The substratum, to a depth of about 29 inches, is light gray loam. Below this to a depth of about 60 inches is soft bedrock. In some places the soil is fine sandy loam throughout. In other places, the dark surface layer is more than 16 inches thick and the soft bedrock is not evident within a depth of 40 inches.

Included with these soils in mapping are small areas of Arnegard, Daglum, Regent, and Rhoades soils. The Arnegard soils are not underlain by soft bedrock. They are on concave slopes and in drainageways. The Daglum and Rhoades soils have an alkali subsoil. They are on the lower side slopes and in drainageways. The Regent soils contain more clay and less silt than the Cabba and Amor soils. They are on smooth side slopes. Included soils make up 15 to 20 percent of the unit.

Permeability is moderate in the Cabba and Amor soils, and surface runoff is rapid. Available water capacity is low. Organic matter content is moderate.

Most areas are used for range. The potential is poor for cultivated crops and for range, windbreaks and environmental plantings, sanitary facilities, and dwellings.

These soils are generally unsuited to cultivated crops because they are subject to water erosion and are strongly sloping. The hazard of water erosion is severe on the Cabba soil and moderate on the Amor soil.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are poorly suited to sanitary facilities and dwellings because they are shallow and moderately deep and are strongly sloping. The measures needed to overcome these limitations are costly. In this survey area these soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is VIe.

15E—Cabba-Amor loams, 15 to 50 percent slopes. These are shallow and moderately deep, moderately steep to very steep, well drained soils on upland benches and divides dissected by well defined drainageways. Individual areas range from about 40 to several hundred acres in size. They are about 55 to 65 percent steep and very steep Cabba soil and 20 to 30 percent moderately steep Amor soil. The Cabba soil is on ridgetops and the upper side slopes. The Amor soil is on the plane and slightly concave mid and lower side slopes and on foot slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Cabba soil has a surface layer of grayish brown loam about 4 inches thick. The next 6 inches is grayish brown loam. The substratum, to a depth of about 17 inches, is pale yellow clay loam. Below this to a depth of about 60 inches is soft bedrock. In places the soft bedrock is within a depth of 10 inches.

Typically, the Amor soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is grayish brown loam about 13 inches thick. The substratum, to a depth of about 23 inches, is light gray loam. Below this to a depth of about 60 inches is soft bedrock. In some places the soil is fine sandy loam throughout. In others, the dark colors extend to a greater depth and the soft bedrock is not evident within a depth of 40 inches.

Included with these soils in mapping are small areas of Arnegard, Daglum, Regent, and Rhoades soils. The Arnegard soils are not underlain by soft bedrock. They are on toe slopes and in drainageways. The Daglum and Rhoades soils have an alkali subsoil. They are on the lower side slopes and in drainageways. The Regent soils contain more clay and less silt than the Cabba and Amor soils. They are on smooth side slopes. Included soils make up 15 to 20 percent of the unit.

Permeability is moderate in the Cabba and Amor soils, and surface runoff is rapid. Available water capacity is low. Organic matter content is moderate.

Most areas are used for range. The potential is poor for cultivated crops and for range, windbreaks and environmental plantings, sanitary facilities, and dwellings.

These soils are generally unsuited to cultivated crops because they are subject to water erosion and are moderately steep to very steep. The hazard of water erosion is severe on the Cabba soil and moderate on the Amor soil.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are poorly suited to sanitary facilities and dwellings because they are shallow and moderately deep and are moderately steep to very steep. The measures needed to overcome these limitations are costly. In this survey area these soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is VIIe.

17—Stady-Lehr loams, 1 to 3 percent slopes. These are deep, nearly level, well drained and somewhat excessively drained soils on outwash plains and stream valley terraces. Individual areas range from about 20 to more than 100 acres in size. They are about 60 to 70 percent Stady soil and 20 to 30 percent Lehr soil. The Stady soil is moderately deep to sand and gravel. It is on plane and slightly concave side slopes. The Lehr soil is shallow to sand and gravel. It is on knolls, ridgetops, and the upper side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Stady soil has a surface layer of dark grayish brown loam about 9 inches thick. The subsoil is loam about 16 inches thick. It is dark grayish brown in the upper part and light gray in the lower part. The upper part of the substratum is light gray gravelly loam. The lower part to a depth of about 60 inches is light brownish gray gravelly very coarse sand. In some places the

surface layer is silt loam. In other places the subsoil contains more sand and less clay.

Typically, the Lehr soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is dark brown loam about 9 inches thick. The upper part of the substratum is light yellowish brown gravelly loamy sand. The middle part is light brownish gray gravelly sand. The lower part to a depth of about 60 inches is light brownish gray gravelly coarse sand.

Included with these soils in mapping are small areas of Arnegard, Shambo, and Wabek soils, which make up about 10 percent of the unit. The Arnegard and Shambo soils are in concave and plane areas. They are more than 40 inches deep over sand and gravel. The Wabek soils are on sharply convex slopes. They are less than 14 inches deep over sand and gravel.

Permeability is moderate in the upper part of the Stady soil and very rapid in the lower part. It is moderately rapid in the upper part of the Lehr soil and very rapid in the lower part. Surface runoff is slow on both soils. Available water capacity is low. Organic matter content is moderate in the Stady soil and low in the Lehr soil.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for range and windbreaks and good for sanitary facilities and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but they are droughty and subject to soil blowing. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss. Maintaining an optimum level of fertility and seeding in the fall or early in spring obtain the best results from the limited amount of available water. Returning a maximum amount of crop residue to the soil and leaving tall stubble in the fields conserve moisture.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. An adequate plant cover traps snow and thus increases the moisture supply.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Optimum survival, growth, and vigor are unlikely. Grasses and weeds should be eliminated before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored.

The capability subclass is IIIs.

17B—Stady-Lehr loams, 3 to 6 percent slopes. These are deep, gently sloping, well drained and somewhat excessively drained soils on outwash plains and stream valley terraces. Individual areas range from about 10 to more than 100 acres in size. They are about 50 to 60 percent Stady soil and 25 to 35 percent Lehr soil. The Stady soil is moderately deep to sand and gravel. It is on plane and slightly concave side slopes. The Lehr soil is shallow to sand and gravel. It is on knolls, ridgetops, and the upper side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Stady soil has a surface layer of dark grayish brown loam about 7 inches thick. The subsoil is loam about 15 inches thick. The upper part is dark grayish brown, and the lower part is light gray. The upper part of the substratum is light gray gravelly loam. The lower part to a depth of about 60 inches is light brownish gray gravelly very coarse sand. In some places the surface layer is silt loam. In other places the subsoil contains more sand and less clay.

Typically, the Lehr soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is dark brown loam about 9 inches thick. The upper part of the substratum is light yellowish brown gravelly loamy sand. The middle part is light brownish gray gravelly sand. The lower part to a depth of about 60 inches is light brownish gray gravelly coarse sand.

Included with these soils in mapping are small areas of Arnegard, Shambo, and Wabek soils, which make up 10 to 15 percent of the unit. The Arnegard and Shambo soils are in concave and plane areas. They are more than 40 inches deep over sand and gravel. The Wabek soils are in convex areas. They are less than 14 inches deep over sand and gravel.

Permeability is moderate in the upper part of the Stady soil and very rapid in the lower part. It is moderately rapid in the upper part of the Lehr soil and very rapid in the lower part. Surface runoff is slow on the Stady soil and medium on the Lehr soil. Available water capacity is low in both soils. Organic matter content is moderate in the Stady soil and low in the Lehr soil.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for range and windbreaks and good for sanitary facilities and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but they are droughty and subject to soil blowing. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss. Maintaining an optimum level of fertility and seeding in the fall or early in spring obtain the best results from the limited amount of available water. Returning a maximum amount of crop residue to the soil and leaving tall stubble in the fields conserve moisture.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. An adequate plant cover traps snow and thus increases the moisture supply.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Optimum survival, growth, and vigor are unlikely. Grasses and weeds should be removed before the trees are planted and should be controlled after the windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored.

The capability subclass is IIIe.

17C—Stady-Lehr loams, 6 to 9 percent slopes. These deep, gently rolling, well drained and somewhat excessively drained soils are on outwash plains and stream valley terraces. Individual areas range from about 5 to 80 acres in size. They are about 50 to 60 percent Stady soil and 20 to 30 percent Lehr soil. The Stady soil is moderately deep to sand and gravel. It is on plane and slightly concave side slopes. The Lehr soil is shallow to sand and gravel. It is on knolls, ridgetops, and the upper side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Stady soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is loam about 14 inches thick. It is dark grayish brown in the upper part and light gray in the lower part. The upper part of the substratum is light gray gravelly loam. The lower part to a depth of about 60 inches is light brownish gray gravelly very coarse sand. In places the subsoil contains more sand and less clay.

Typically, the Lehr soil has a surface layer of dark grayish brown loam about 5 inches thick. The subsoil is dark brown loam about 9 inches thick. The upper part of the substratum is light yellowish brown gravelly loamy sand. The middle part is light brownish gray gravelly sand. The lower part to a depth of about 60 inches is light brownish gray gravelly coarse sand.

Included with these soils in mapping are small areas of Arnegard, Shambo, and Wabek soils, which make up 10 to 15 percent of the unit. The Arnegard and Shambo soils are in concave and plane areas. They are more than 40 inches deep over sand and gravel. The Wabek soils are in convex areas. They are less than 14 inches deep over sand and gravel.

Permeability is moderate in the upper part of the Stady soil and very rapid in the lower part. It is moderately rapid in the upper part of the Lehr soil and very rapid in the lower part. Surface runoff is medium on the Stady soil and slow on the Lehr soil. Available water capacity is low in both soils. Organic matter content is moderate in the Stady soil and low in the Lehr soil.

Most areas are used for pasture or range. The potential is fair for range, cultivated crops, and windbreaks and good for sanitary facilities and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but they are subject to water erosion and soil blowing and are droughty. The hazards of soil blowing and water erosion are moderate. Stubble mulching and contour stripcropping help to prevent excessive soil loss. Maintaining an optimum level of fertility and seeding in the fall or early in spring obtain the best results from the limited amount of available water. Returning a maximum amount of crop residue to the soil and leaving tall stubble in the fields conserve moisture.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. An adequate plant cover traps snow and thus increases the moisture supply. Also, it reduces the runoff rate.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Optimum survival, growth, and vigor are unlikely. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The slope is a limitation for septic tank absorption fields, but it can be overcome by establishing the field on the contour. The sides of shallow excavations can cave in unless they are shored.

The capability subclass is IVe.

18B—Reeder-Rhoades silt loams, 3 to 6 percent slopes. These moderately deep and deep, gently sloping, well drained and moderately well drained soils are on upland plains. Individual areas range from 10 to 60 acres in size. They are 65 to 75 percent Reeder soil and 20 to 30 percent Rhoades soil. The Reeder soil is on plane and convex side slopes. The Rhoades soil has an alkali subsoil. It is in scattered slightly concave depressions where scabby spots are evident. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Reeder soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is loam about 13 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive loam about 9 inches thick. Below this to a depth of 60 inches is soft bedrock. In some places the surface layer is loam. In other places the dark colors extend to a depth of more than 16 inches.

Typically, the Rhoades soil has a surface layer of dark grayish brown silt loam about 4 inches thick. The subsoil is silty clay about 12 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum is about 33 inches thick. It is light yellowish brown silty clay loam in the upper part and pale olive silty clay in the lower part. Below this to a

depth of about 60 inches is soft bedrock. In places the surface layer is 5 to 15 inches thick.

Included with these soils in mapping are small areas of Arnegard soils in swales. These included soils make up about 5 to 10 percent of the unit. They do not have soft bedrock within a depth of 40 inches.

Permeabilty is moderate in the Reeder soil and very slow in the Rhoades soil. Surface runoff is medium. Available water capacity is low. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for range, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss. Applying barnyard manure and returning crop residue to the soil increase the organic matter content, improve tilth, and conserve moisture. The depth to which roots can penetrate is restricted by the alkali subsoil of the Rhoades soil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Reeder soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Rhoades soil is generally unsuited. Nearly all climatically adapted species can grow well on the Reeder soil. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. They are underlain by soft bedrock, which can be easily excavated. The very slow permeability of the Rhoades soil is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation. The shrink-swell potential of both soils is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

18C—Reeder-Rhoades silt loams, 6 to 9 percent slopes. These moderately deep and deep, moderately sloping, well drained and moderately well drained soils are on uplands dissected by shallow drainageways. Individual areas range from 10 to 40 acres in size. They are 55 to 65 percent Reeder soil and 25 to 35 percent Rhoades soil. The Reeder soil is on plane and convex side slopes. The Rhoades soil has an alkali subsoil. It is in scattered slightly concave depressions where scabby spots are evident. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Reeder soil has a surface layer of dark grayish brown silt loam about 6 inches thick. The subsoil is loam about 12 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive loam about 9 inches thick. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is loam. In other places the dark colors extend to a depth of more than 16 inches.

Typically, the Rhoades soil has a surface layer of dark grayish brown silt loam about 3 inches thick. The subsoil is silty clay about 11 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum is about 31 inches thick. It is light yellowish brown silty clay loam in the upper part and pale olive silty clay in the lower part. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is 5 to 15 inches thick.

Included with these soils in mapping are small areas of Arnegard soils in swales. These included soils make up 5 to 10 percent of the unit. They do not have soft bedrock within a depth of 40 inches.

Permeability is moderate in the Reeder soil and very slow in the Rhoades soil. Surface runoff is medium on both soils. Available water capacity is low. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for range, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching, stripcropping, and grassed waterways help to prevent excessive soil loss. Applying barnyard manure and returning crop residue to the soil increase the organic matter content, improve tilth, and conserve moisture. The depth to which roots can penetrate is restricted by the alkali subsoil in the Rhoades soil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Reeder soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Rhoades soil is generally unsuited. Nearly all climatically adapted species can grow well on the Reeder soil. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. They are underlain by soft bedrock, which can be easily excavated. The very slow permeability of the Rhoades soil is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation. The shrink-swell potential of both soils is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

19—Straw silt loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is on flood plains. It

is subject to flooding. Individual areas range from 15 to several hundred acres in size and are linear in shape.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 16 inches thick. The substratum to a depth of about 60 inches is silt loam. The upper part is light brownish gray, and the lower part is grayish brown. In places the soil contains less silt and more sand.

Included with this soil in mapping are small areas of Lehr, Shambo, and Stady soils. The Lehr and Stady soils are in convex areas. The Lehr soils are 14 to 20 inches deep over sand and gravel, and the Stady soils are 20 to 40 inches deep over sand and gravel. The Shambo soils are dark to a depth of less than 16 inches. They are in slightly convex areas. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Straw soil, and surface runoff is slow. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range and windbreaks and poor for sanitary facilities and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condtion.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is poorly suited to sanitary facilities and dwellings because it is subject to flooding. The measures needed to overcome the flood hazard are costly. In this survey area Straw soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is IIc.

21—Shambo loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is on plane and slightly convex terraces and outwash plains. Individual areas range from 10 to 120 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown loam, and the lower part is light yellowish brown silt loam. The upper part of the substratum is light yellowish brown silt loam. The lower part to a depth of about 60 inches is pale olive loam. In some places the surface layer is silt loam. In other places the subsoil contains less silt and more sand.

Included with this soil in mapping are small areas of Arnegard, Lehr, Stady, and Straw soils, which make up 10 to 15 percent of the unit. The Arnegard and Straw soils have a surface layer that is thicker than that of the Shambo soil. They are in concave areas. The Lehr and Stady soils are on the tops of knolls and ridges. They are less than 40 inches deep over sand and gravel.

Permeability is moderate in the Shambo soil. Available water capacity is high, and surface runoff is slow. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIc.

21B—Shambo loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on plane and slightly convex terraces and outwash plains. Individual areas range from 10 to 100 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown loam, and the lower part is light yellowish brown silt loam. The upper part of the substratum is light yellowish brown silt loam. The lower part to a depth of about 60 inches is pale olive loam. In some places the surface layer is silt loam. In other places the subsoil contains less silt and more sand.

Included with this soil in mapping are small areas of Arnegard, Lehr, and Stady soils, which make up 10 to 15 percent of the unit. The Arnegard soils have a surface layer that is thicker than that of the Shambo soil. They are in concave areas. The Lehr and Stady soils are on the tops of knolls and ridges. They are less than 40 inches deep over sand and gravel.

Permeability is moderate in the Shambo soil. Available water capacity is high, and surface runoff is medium. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all the climatically adapted species can grow well. Grasses and weeds should be eliminated before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

22—Belfield-Daglum silt loams, 1 to 3 percent slopes. These deep, nearly level, well drained and moderately well drained, alkali soils are on dissected uplands and terraces. Individual areas range from 10 to 80 acres in size. They are 65 to 75 percent Belfield soil and 15 to 25 percent Daglum soil. The Belfield soil is in plane and slightly concave areas, and the Daglum soil is in slightly convex areas. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Belfield soil has a dark grayish brown silt loam surface layer about 10 inches thick. The next 4 inches is light gray and grayish brown silt loam. The subsoil is about 29 inches thick. The upper part is dark grayish brown silty clay, the middle part is light yellowish brown silty clay loam, and the lower part is light yellowish brown silty clay. The substratum to a depth of about 60 inches is pale yellow loam. In some places the surface layer is loam. In other places the subsoil contains less clay and more silt.

Typically, the Daglum soil has a surface layer of dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is silty clay about 20 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum, to a depth of about 46 inches, is light yellowish brown silty clay loam. Below this to a depth of 60 inches is soft bedrock. In some places the surface layer is loam. In other places the subsoil contains less clay and more silt.

Included with these soils in mapping are small areas of Farland, Reeder, Rhoades, and Straw soils, which make up 10 to 15 percent of the unit. The Farland, Reeder, and Straw soils do not have an alkali subsoil. The Farland and Reeder soils are in plane and convex areas and the Straw soils in concave areas. The Rhoades soils have gypsum within a depth of 16 inches.

Permeability is slow in the Belfield soil and very slow in the Daglum soil. Available water capacity is moderate. Surface runoff is medium. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for windbreaks, sanitary facilities, and dwellings and good for range.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but they are subject to soil blowing. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and field windbreaks help to prevent excessive soil loss. Applying barnyard manure and returning crop residue to the soil increase the organic matter content, improve tilth, and conserve moisture. The depth to which roots can penetrate is restricted by the alkali subsoil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Belfield soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Daglum soil is generally unsuited. Some of the climatically adapted species can grow well on the Belfield soil. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The Belfield soil is generally better suited than the Daglum soil. The slow or very slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIs.

22B—Belfield-Daglum silt loams, 3 to 6 percent slopes. These deep, gently sloping, well drained and moderately well drained, alkali soils are on dissected uplands and terraces. Individual areas range from 10 to 100 acres in size. They are 65 to 75 percent Belfield soil and 15 to 25 percent Daglum soil. The Belfield soil is in plane and slightly concave areas and the Daglum soil in slightly convex areas. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Belfield soil has a dark grayish brown silt loam surface layer about 10 inches thick. The next 4 inches is light gray and grayish brown silt loam. The subsoil is about 29 inches thick. The upper part is dark grayish brown silty clay, the middle part is light yellowish brown silty clay loam, and the lower part is light

yellowish brown silty clay. The substratum to a depth of about 60 inches is pale yellow loam. In some places the surface layer is loam. In other places the subsoil contains less clay and more silt.

Typically, the Daglum soil has a surface layer of dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is silty clay about 20 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum, to a depth of about 46 inches, is light yellowish brown silty clay loam. Below this to a depth of 60 inches is soft bedrock. In some places the surface layer is loam. In other places the subsoil contains less clay and more silt.

Included with these soils in mapping are small areas of Farland, Reeder, Rhoades, and Straw soils, which make up 10 to 15 percent of the unit. The Farland, Reeder, and Straw soils do not have an alkali subsoil. The Farland and Reeder soils are in plane and convex areas and the Straw soils in concave areas. The Rhoades soils have gypsum within a depth of 16 inches.

Permeability is slow in the Belfield soil and very slow in the Daglum soil. Available water capacity is moderate. Surface runoff is medium. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for sanitary facilities and dwellings, good for range, and fair to poor for windbreaks.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching and field windbreaks help to prevent excessive soil loss. Applying barnyard manure and returning crop residue to the soil increase the organic matter content, improve tilth, and conserve moisture. The depth to which roots can penetrate is restricted by the alkali subsoil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Belfield soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Daglum soil is generally unsuited. Some of the climatically adapted species can grow well on the Belfield soil. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The Belfield soil is generally better suited than the Daglum soil. The slow or very slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

23D—Vebar-Cohagen fine sandy loams, 9 to 15 percent slopes. These moderately deep and shallow, strongly sloping, well drained soils are on upland benches and divides dissected by well defined drainageways. Individual areas range from about 40 to several hundred acres in size. They are about 65 to 75 percent Vebar soil and 20 to 30 percent Cohagen soil. The Vebar soil is on the mid and lower side slopes and on foot slopes. The Cohagen soil is on ridgetops and the upper side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Vebar soil has a surface layer of brown fine sandy loam about 7 inches thick. The subsoil is fine sandy loam about 16 inches thick. The upper part is brown, and the lower part is pale brown. The substratum is light yellowish brown loamy fine sand about 7 inches thick. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is loam.

Typically, the Cohagen soil has a surface layer of grayish brown fine sandy loam about 3 inches thick. The substratum is pale brown fine sandy loam about 13 inches thick. Below this to a depth of about 60 inches is soft bedrock.

Included with these soils in mapping are small areas of Amor, Flasher, and Parshall soils, which make up to 10 to 15 percent of the unit. The Amor soils are in positions similar to those of the Vebar soil. They contain more clay and less sand than that soil. The Flasher soils are in positions similar to those of the Cohagen soil. They contain more sand and less clay than that soil. The Parshall soils do not have soft bedrock within a depth of 60 inches. They are in drainageways and in concave areas along foot slopes.

Permeability is moderately rapid in the Vebar and Cohagen soils, and surface runoff is rapid. Available water capacity is low in the Vebar soil and very low in the Cohagen soil. Organic matter content is low in both soils.

Most areas are used for range. The potential is poor for cultivated crops and fair for range, windbreaks, sanitary facilities, and dwellings.

These soils are generally unsuited to cultivated crops because they are subject to water erosion and soil blowing and are strongly sloping. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Vebar soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Cohagen soil is generally unsuited. A few of the climatically adapted species can grow well on the Vebar soil, but optimum survival, growth, and vigor are unlikely. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. They are underlain by soft bedrock, which can be easily excavated. The slope is a limitation on sites for shallow excavations and dwellings, but it can be overcome by cutting and filling.

The capability subclass is VIe.

23E—Vebar-Cohagen fine sandy loams, 15 to 50 percent slopes. These moderately deep and shallow, moderately steep to very steep, well drained soils are on upland benches and divides dissected by well defined drainageways. Individual areas range from about 25 to several hundred acres in size. They are about 55 to 65 percent Vebar soil and 25 to 35 percent Cohagen soil. The Vebar soil is on the mid and lower side slopes and on foot slopes. The Cohagen soil is on ridgetops and the upper side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Vebar soil has a surface layer of brown fine sandy loam about 5 inches thick. The subsoil is fine sandy loam about 11 inches thick. The upper part is brown, and the lower part is pale brown. The substratum is light yellowish brown loamy fine sand about 6 inches thick. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is loam.

Typically, the Cohagen soil has a surface layer of grayish brown fine sandy loam about 3 inches thick. The substratum is pale brown fine sandy loam about 13 inches thick. Below this to a depth of about 60 inches is soft bedrock.

Included with these soils in mapping are small areas of Amor, Flasher, and Parshall soils, which make up 10 to 15 percent of the unit. The Amor soils are in positions similar to those of the Vebar soil. They contain more clay and less sand than that soil. The Flasher soils are in positions similar to those of the Cohagen soil. They contain more sand and less clay than that soil. The Parshall soils are in drainageways and in concave areas along foot slopes. They do not have soft bedrock within a depth of 60 inches.

Permeability is moderately rapid in the Vebar and Cohagen soils, and surface runoff is rapid. Available water capacity is low in the Vebar soil and very low in the Cohagen soil. Organic matter content is low in both soils.

Most areas are used for range. The potential is poor for cultivated crops and for windbreaks and environmental plantings, sanitary facilities, and dwellings and fair for range.

These soils are generally unsuited to cultivated crops. As a result of the erosion hazard and the slope, cultivation is impractical.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are poorly suited to sanitary facilities and dwellings because they are moderately steep to very steep. The measures needed to overcome the slope are costly. In this survey area these soils generally are not used as building sites. Better sites are generally nearby.

The capability subclass is VIIe.

24—Grassna silt loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is on broad flats and in long drainageways on uplands. The surface is plane and concave. Individual areas range from about 10 to more than 80 acres in size.

Typically, the surface layer, subsurface layer, and subsoil are dark grayish brown silt loam. The surface layer is about 7 inches thick, the subsurface layer is about 10 inches thick, and the subsoil is about 23 inches thick. The substratum to a depth of about 60 inches is pale yellow silt loam. In some places glacial till or soft bedrock is at a depth of 40 to 60 inches. In other places the dark colors extend to a depth of less than 16 inches.

Included with this soil in mapping are small areas of Tonka soils, which make up about 5 percent of the unit. These soils are poorly drained and are in closed depressions.

Permeability is moderate in the Grassna soil, and surface runoff is slow. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIc.

24B—Grassna silt loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on smooth flats and in long drainageways on uplands. The surface is plane and slightly concave. Individual areas range from 10 to more than 100 acres in size.

Typically, the surface layer, subsurface layer, and subsoil are dark grayish brown silt loam. The surface

layer is about 7 inches thick, the subsurface layer is about 10 inches thick, and the subsoil is about 23 inches thick. The substratum to a depth of about 60 inches is pale yellow silt loam. In some places glacial till or soft bedrock is at a depth of 30 to 60 inches. In other places the dark colors extend to a depth of less than 16 inches.

Included with this soil in mapping are small areas of Tonka soils, which make up about 5 percent of the unit. These soils are poorly drained and are in closed depressions.

Permeability is moderate in the Grassna soil, and surface runoff is medium. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and contour stripcropping help to control erosion.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

25B—Flaxton fine sandy loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on uplands. The surface is plane and slightly concave. Individual areas range from 10 to 80 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is fine sandy loam about 20 inches thick. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. The subsoil is about 26 inches thick. The upper part is grayish brown loamy fine sand, the middle part is light yellowish brown clay loam, and the lower part is light brownish gray clay loam. The substratum to a depth of about 60 inches is pale olive clay loam. In places the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Lihen, Parshall, and Williams soils, which make up 10 to 15 percent of the unit. The Lihen and Parshall soils do not have glacial till within a depth of 40 inches. The Lihen soils are in convex areas, and the Parshall soils are in concave areas. The Williams soils are on ridgetops and knolls. Their surface layer is thinner than that of the Flaxton soil.

Permeability is moderately rapid in the upper part of the Flaxton soil and moderately slow in the substratum. Surface runoff is medium. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, sanitary facilities, and dwellings and fair for windbreaks.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. The hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

25C—Flaxton fine sandy loam, 6 to 9 percent slopes. This deep, gently rolling, well drained soil is on uplands. The surface is plane and slightly concave. Individual areas range from 15 to more than 100 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is fine sandy loam about 20 inches thick. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. The subsoil is about 26 inches thick. The upper part is grayish brown loamy fine sand, the middle part is light yellowish brown clay loam, and the lower part is light brownish gray clay loam. The substratum to a depth of about 60 inches is pale olive clay loam. In places the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Lihen, Parshall, and Williams soils, which make up 10 to 15 percent of the unit. The Lihen and Parshall soils do not have glacial till within a depth of 40 inches. The Lihen soils are in convex areas, and the Parshall soils are in drainageways and on toe slopes. The Williams soils are on ridgetops and knolls. Their surface layer is thinner than that of the Flaxton soil.

Permeability is moderately rapid in the upper part of the Flaxton soil and moderately slow in the substratum.

Surface runoff is medium. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for windbreaks and good for range, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. The hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IVe.

25D—Flaxton fine sandy loam, 9 to 15 percent slopes. This deep, rolling, well drained soil is on uplands. The surface is plane and slightly concave. Individual areas range from 10 to 60 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is fine sandy loam about 20 inches thick. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. The subsoil is about 26 inches thick. The upper part is grayish brown loamy fine sand, the middle part is light yellowish brown clay loam, and the lower part is light brownish gray clay loam. The substratum to a depth of about 60 inches is pale olive clay loam. In places the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Parshall and Williams soils, which make up 10 to 15 percent of the unit. The Parshall soils do not have glacial till within a depth of 40 inches. They are in drainageways and on toe slopes. The Williams soils are on ridgetops and knolls. Their surface layer is thinner than that of the Flaxton soil.

Permeability is moderately rapid in the upper part of the Flaxton soil and moderately slow in the substratum. Surface runoff is medium. Available water capacity is high. Organic matter content also is high.

Most areas are used for range. The potential is poor for cultivated crops, good for range, and fair for windbreaks, sanitary facilities, and dwellings.

This soil is generally unsuited to wheat, oats, barley, flax, grasses, and legumes because the hazard of soil blowing is severe. The hazard of water erosion is slight. The slope hinders the movement of farm machinery.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The slope, the shrink-swell potential, and low strength are limitations on sites for dwellings. The shrink-swell potential and low strength, however, can be overcome by strengthening foundations and basement walls, and the slope can be overcome by cutting and filling.

The capability subclass is VIe.

26B—Krem loamy fine sand, 1 to 6 percent slopes. This deep, nearly level and undulating, well drained soil is on slightly concave to slightly convex slopes on uplands. Individual areas range from 10 to more than 100 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 6 inches thick. The subsoil is about 34 inches thick. The upper part is brown loamy fine sand, and the lower part is light brownish gray loam. The substratum to a depth of about 60 inches is light brownish gray loam. In some places the surface layer is fine sandy loam. In other places the dark colors extend to a depth of more than 16 inches.

Included with this soil in mapping are small areas of Lihen, Parshall, and Williams soils, which make up 10 to 15 percent of the unit. The Lihen and Parshall soils do not have glacial till within a depth of 40 inches. The Lihen soils are on the upper side slopes, and the Parshall soils are in swales and drainageways. The Williams soils have a loam surface layer. They are on ridgetops and knolls.

Permeability is rapid in the upper part of the Krem soil and moderately slow in the substratum. Surface runoff is medium. Available water capacity is moderate. Organic matter content is low.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for windbreaks and good for range, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. The hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of

grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IVe.

26C—Krem loamy fine sand, 6 to 9 percent slopes. This deep, gently rolling, well drained soil is on slightly concave to slightly convex slopes on uplands. Individual areas range from 10 to 120 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 6 inches thick. The subsoil is about 28 inches thick. The upper part is brown loamy fine sand, and the lower part is light brownish gray loam. The substratum to a depth of about 60 inches is light brownish gray loam. In places the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Lihen, Parshall, and Williams soils, which make up 10 to 15 percent of the unit. The Lihen and Parshall soils do not have glacial till within a depth of 40 inches. The Lihen soils are on the upper side slopes, and the Parshall soils are in swales and drainageways. The Williams soils have a loam surface layer. They are on ridgetops and knolls.

Permeability is rapid in the upper part of the Krem soil and moderately slow in the substratum. Surface runoff is medium. Available water capacity is moderate. Organic matter content is low.

Most areas are used for cultivated crops. The potential is poor for cultivated crops, good for range, sanitary facilities, and dwellings, and fair for windbreaks.

This soil is generally unsuited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is severe, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is VIe.

28—Grail silty clay loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is in plane and concave areas on uplands and in broad drainageways. Individual areas range from 10 to 120 acres in size and generally are irregular in shape.

Typically, the surface layer is dark grayish brown silty clay loam about 7 inches thick. The subsoil is dark gray silty clay about 27 inches thick. The upper part of the substratum is grayish brown silty clay loam. The lower part to a depth of about 60 inches is light yellowish brown loam. In places the surface layer and subsoil contain less clay and more silt.

Included with this soil in mapping are small areas of Belfield, Daglum, and Regent soils, which make up 10 to 15 percent of the unit. The Belfield and Daglum soils have an alkali subsoil. They are in scattered micro depressions and swales. The Regent soils have soft bedrock within a depth of 40 inches. They are on ridgetops and knolls.

Permeability is moderately slow in the Grail soil. Surface runoff is slow. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range and windbreaks and fair for sanitary facilities and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIc.

29—Harriet silt loam. This deep, level, poorly drained, alkali soil is on flood plains and low terraces. It is commonly ponded during snowmelt and during periods of heavy rainfall. The surface is plane and slightly concave. In the areas that support native grass, the landscape is pitted with micro depressions. Individual areas range from 10 to more than 150 acres in size.

Typically, the surface layer is gray silt loam about 3 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown clay loam, and the lower part is light brownish gray silty clay loam. The substratum to a depth of about 60 inches is silty clay loam. It is grayish brown in the upper part and olive in the lower part. In some areas the subsoil contains less clay. In areas that have no plant cover, it is exposed.

Included with this soil in mapping are small areas of Arnegard, Daglum, Grail and Rhoades soils, which make up 10 to 15 percent of the unit. The Arnegard and Grail soils do not have an alkali subsoil. They are well drained. The Daglum and Rhoades soils are moderately well drained. All of the included soils are higher on the landscape than this Harriet soil.

Permeability is slow in the Harriet soil. Surface runoff also is slow. A seasonal high water table is evident following snowmelt and after periods of heavy rainfall. Available water capacity is moderate. Organic matter content also is moderate. Visible salts are within a depth of 16 inches.

Most areas are used for range. The potential is good for range. It is poor for cultivated crops because of the wetness, the salinity, and the excess sodium. It also is poor for windbreaks and environmental plantings, sanitary facilities, and dwellings.

A cover of range or pasture plants or of hay keeps this soil in good condition. Uniform distribution of grazing, deferred grazing, and proper stocking rates help to keep the pasture or range in good condition. If the range condition has deteriorated, the yield of desirable forage is seriously reduced and recovery is slow. Pitting or furrowing, followed by a rest period, reestablishes desirable plants and can improve some deteriorated areas. Because this soil is wet, heavy grazing and trampling early in the growing season can easily damage the plant cover.

This soil is unsuitable as a site for sanitary facilities and dwellings because of the high water table, the ponding, and the slow permeability. The measures needed to overcome these limitations are costly. The soil is generally not used as a building site. Better sites are generally nearby.

The capability subclass is VIw.

31—Parnell silty clay loam, ponded. This deep, level, very poorly drained soil is in depressions in the uplands. It is frequently ponded for very long periods after snowmelt and after heavy rainfall. Individual areas range from 10 to 60 acres in size.

Typically, the surface layer is black and is about 9 inches thick. The upper part is silty clay loam, and the lower part is silty clay. The subsoil is about 25 inches thick. The upper part is dark olive gray clay, and the lower part is dark gray silty clay. The substratum to a depth of about 60 inches is olive gray silty clay. In places 4 to 6 inches of muck overlies the surface layer.

Included with this soil in mapping are small areas of Hamerly and Tonka soils, which make up 5 to 10 percent of the unit. The Hamerly soils are somewhat poorly drained and are on the rims of depressions and on slight knolls. The Tonka soils are poorly drained and are on the outer edges of depressions.

Permeability is slow in the Parnell soil, and surface runoff is ponded. The soil has a seasonal high water table. Available water capacity is high. Organic matter content also is high.

Most areas are used for wildlife habitat. The potential is poor for cultivated crops because of the wetness and the ponding. It is also poor for range, windbreaks and environmental plantings, sanitary facilities, and dwellings.

This soil is poorly suited to range, pasture, and hay. Because of the wetness, the only suitable grazing period is late in summer.

This soil is poorly suited to most engineering uses because of the high water table and the ponding. The measures needed to overcome these limitations are costly. The soil is not used as a building site. Better sites are generally nearby.

The capability subclass is VIIw.

32B—Lihen loamy fine sand, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on plane and convex stream and outwash terraces. Individual areas range from 15 to several hundred acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown loamy fine sand about 12 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 5 inches thick. The upper part of the substratum is grayish brown loamy fine sand. The lower part to a depth of about 60 inches is light brownish gray fine sand. In places the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Parshall and Telfer soils, which make up 10 to 15 percent of the unit. The Parshall soils are fine sandy loam throughout. They are in concave areas. The Telfer soils are dark to a depth of less than 16 inches. They are on ridgetops and knolls.

Permeability is rapid in the Lihen soil, and surface runoff is slow. Available water capacity is moderate. Organic matter content is low.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, sanitary facilities, and dwellings and fair for windbreaks.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of

grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored by trench walls.

The capability subclass is IVe.

32C—Lihen loamy fine sand, 6 to 9 percent slopes. This deep, moderately sloping, well drained soil is on plane and concave stream and outwash terraces. Individual areas range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown loamy fine sand about 12 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 5 inches thick. The upper part of the substratum is grayish brown loamy fine sand. The lower part to a depth of about 60 inches is light brownish gray fine sand. In places the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Parshall and Telfer soils, which make up 10 to 15 percent of the unit. The Parshall soils contain less sand and more clay than the Lihen soil. They are in concave areas. The Telfer soils are on ridgetops and knolls. They are dark to a depth of less than 16 inches.

Permeability is rapid in the Lihen soil, and surface runoff is slow. Available water capacity is moderate. Organic matter content is low.

Most areas are used for cultivated crops or for range. The potential is poor for cultivated crops, good for range, sanitary facilities, and dwellings, and fair for windbreaks.

This soil is generally unsuited to cultivated crops because of a severe hazard of soil blowing and the slope. Overcoming these limitations is difficult.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored by trench walls.

The capability subclass is VIe.

33B—Parshall-Lihen fine sandy loams, 1 to 6 percent slopes. These deep, nearly level and gently sloping, well drained soils are in upland swales and on low stream terraces and outwash plains. Individual areas range from 10 to several hundred acres in size. They are about 60 to 70 percent Parshall soil and 20 to 30 percent Lihen soil. The Parshall soil is in plane and convex areas. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Parshall soil has a surface layer of dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is dark grayish brown fine sandy loam about 15 inches thick. The subsoil is yellowish brown fine sandy loam about 9 inches thick. The substratum to a depth of about 60 inches is light brownish gray. The upper part is sandy loam, the middle part is loam, and the lower part is fine sandy loam. In places loamy fine sand is below a depth of 40 inches.

Typically, the Lihen soil has a surface layer of dark grayish brown fine sandy loam about 12 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 5 inches thick. The upper part of the substratum is grayish brown loamy fine sand. The lower part to a depth of about 60 inches is light brownish gray fine sand. In places the surface layer is loamy fine sand.

Included with these soils in mapping are small areas of Arnegard, Manning, and Telfer soils, which make up 10 to 15 percent of the unit. The Arnegard soils contain more clay and less sand than the Parshall and Lihen soils. They are in well defined drainageways. The Manning soils have sand and gravel within a depth of 40 inches. They are in plane and slightly convex areas. The Telfer soils are in positions similar to those of the Lihen soil. They are dark to a depth of less than 16 inches.

Permeability is moderately rapid in the Parshall soil and rapid in the Lihen soil. Surface runoff is slow on both soils. Available water capacity is high in the Parshall soil and moderate in the Lihen soil. Organic matter content is moderate in the Parshall soil and low in the Lihen soil.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well on the Parshall soil, but only a few can grow well on the Lihen soil. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored by trench walls.

The capability subclass is IIIe.

33C—Parshall-Lihen fine sandy loams, 6 to 9 percent slopes. These deep, moderately sloping, well drained soils are in upland swales and on low stream terraces and outwash plains. Individual areas range from 10 to 60 acres in size. They are about 50 to 60 percent Parshall soil and 30 to 40 percent Lihen soil. The Parshall soil is in plane and concave areas. The Lihen soil is in plane and convex areas. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Parshall soil has a surface layer of dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is dark grayish brown fine sandy loam about 15 inches thick. The subsoil is yellowish brown fine sandy loam about 7 inches thick. The substratum to a depth of about 60 inches is light brownish gray. It is sandy loam in the upper part, loam in the middle part, and fine sandy loam in the lower part. In places loamy fine sand is below a depth of 40 inches.

Typically, the Lihen soil has a surface layer of dark grayish brown fine sandy loam about 12 inches thick. The subsurface layer is dark grayish brown loamy fine sand about 5 inches thick. The upper part of the substratum is grayish brown loamy fine sand. The lower part to a depth of about 60 inches is light brownish gray fine sand. In places the surface layer is loamy fine sand.

Included with these soils in mapping are small areas of Arnegard, Manning, and Telfer soils, which make up 10 to 15 percent of the unit. The Arnegard soils contain more clay and less sand than the Parshall and Lihen soils. They are in well defined drainageways. The Manning soils have sand and gravel within a depth of 40 inches. They are in plane and slightly convex areas. The Telfer soils are in positions similar to those of the Lihen soil. They are dark to a depth of less than 16 inches.

Permeability is moderately rapid in the Parshall soil and rapid in the Lihen soil. Surface runoff is slow on both soils. Available water capacity is high in the Parshall soil and moderate in the Lihen soil. Organic matter content is moderate in the Parshall soil and low in the Lihen soil.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well on the Parshall soil, but only a few can grow well on the Lihen soil. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored by trench walls.

The capability subclass is IVe.

35C—Sutley silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is in convex areas on uplands dissected by shallow drainageways. Individual areas range from 10 to 60 acres in size.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The substratum to a depth of about 60 inches is silt loam. The upper part is light brownish gray, and the lower part is light gray. In places soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Bryant, Cabba, and Grassna soils, which make up about 15 percent of the unit. The Bryant and Grassna soils have a subsoil. The Bryant soils are in plane and slightly convex areas, and the Grassna soils are in concave areas. The Cabba soils have soft bedrock within a depth of 20 inches. They are on knolls and ridgetops.

Permeability is moderate in the Sutley soil. Surface runoff is medium. Available water capacity is high. Organic matter content is moderate.

Most areas are used for range. The potential is fair for range and cultivated crops and good for windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, barley, oats, flax, grasses, and legumes, but the hazard of soil blowing is moderate and the hazard of water erosion is severe. Stubble mulching, grassed waterways, and contour stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. Low strength is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

35E—Sutley silt loam, 9 to 35 percent slopes. This deep, strongly sloping to steep, well drained soil is in convex areas on uplands dissected by well defined drainageways. Individual areas range from 10 to 40 acres in size.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The substratum to a depth of about 60 inches is silt loam. The upper part is light brownish gray, and the lower part is light gray. In places soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Bryant, Cabba, and Grassna soils, which make up about 15 percent of the unit. The Bryant and Grassna soils have a subsoil. The Bryant soils are in plane and slightly convex areas, and the Grassna soils are in concave areas. The Cabba soils have soft bedrock within a depth of 20 inches. They are on knolls and ridgetops.

Permeability is moderate in the Sutley soil, and surface runoff is rapid. Available water capacity is high. Organic matter content is moderate.

Most areas are used for range. The potential is poor for cultivated crops and for windbreaks and environmental plantings, sanitary facilities, and dwellings and fair for range.

This soil is generally unsuited to cultivated crops. As a result of the hazard of water erosion, the equipment limitations, and the slope, cultivation is impractical.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is poorly suited to sanitary facilities and dwellings because it is strongly sloping to steep. The measures needed to overcome the slope are costly. The soil is generally not used as a building site. Better sites are generally nearby.

The capability subclass is VIe.

36B—Bryant silt loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is in plane and slightly convex areas on uplands. Individual areas range from 15 to 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is silt loam about 14 inches thick. The upper part is brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is silt loam. It is light brownish gray in the upper part and light yellowish brown in the lower part. In places glacial till or soft bedrock is within a depth of 40 inches. In some areas the dark colors extend to a depth of more than 16 inches.

Included with this soil in mapping are small areas of Tonka soils, which make up about 5 percent of the unit. These poorly drained soils are in slight depressions.

Permeability is moderate in the Bryant soil. Available water capacity is high, and surface runoff is medium. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

36C—Bryant silt loam, 6 to 9 percent slopes. This deep, moderately sloping, well drained soil is on plane and slightly convex uplands. Individual areas range from 10 to 120 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is silt loam about 12 inches thick. The upper part is brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is silt loam. It is light brownish gray in the upper part and light yellowish brown in the lower part. In some areas glacial till or soft bedrock is within a depth of 40 inches.

Included with this soil in mapping are small areas of Sutley soils, which make up about 15 percent of the unit. These soils lack a subsoil. They are on knolls and ridges.

Permeability is moderate in the Bryant soil, and surface runoff is medium. Available water capacity is high. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching and contour stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

40C—Amor-Cabba loams, 6 to 9 percent slopes. These moderately deep and shallow, moderately sloping, well drained soils are on plane and convex uplands dissected by shallow to well defined drainageways. Individual areas range from about 15 to 180 acres in size. They are about 55 to 65 percent Amor soil and 25 to 35 percent Cabba soil. The Amor soil is on the mid and lower side slopes and on foot slopes. The Cabba soil is on ridgetops, knolls, and the upper side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Amor soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is grayish brown loam about 13 inches thick. The substratum, to a depth of about 29 inches, is light gray loam. Below this to a depth of about 60 inches is soft bedrock.

Typically, the Cabba soil has a surface layer of grayish brown loam about 4 inches thick. The next 6 inches also is grayish brown loam. The substratum, to a depth of about 17 inches, is pale yellow clay loam. Below this to a depth of about 60 inches is soft bedrock. In places the soft bedrock is within a depth of 10 inches.

Included with these soils in mapping are small areas of Arnegard and Belfield soils, which make up about 5 to 10 percent of the unit. The Arnegard soils do not have soft bedrock within a depth of 40 inches. Their surface layer is thicker than that of either the Amor soil or the Cabba soil. The Belfield soils have an alkali subsoil. They are on toe slopes and in drainageways.

Permeability is moderate in the Amor and Cabba soils. Available water capacity is low. Surface runoff is medium on the Amor soil and rapid on the Cabba soil. Organic matter content is moderate in both soils.

Most areas are used for range. The potential is fair for cultivated crops and for range and windbreaks and good for sanitary facilities and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is moderate and the hazard of water erosion severe on the Cabba soil. Stubble mulching, grassed waterways, and stripcropping help to control erosion. Generally, only the Amor soil is cultivated.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Amor soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Cabba soil is generally unsuited. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The depth to bedrock is a limitation, but the bedrock is soft and can be easily excavated. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIIe.

40D—Amor-Cabba loams, 9 to 15 percent slopes. These moderately deep and shallow, strongly sloping, well drained soils are on plane and convex uplands dissected by well defined drainageways. Individual areas range from about 10 to 150 acres in size. They are about 55 to 65 percent Amor soil and 25 to 35 percent Cabba soil. The Amor soil is on the mid and lower side slopes and on foot slopes. The Cabba soil is on ridgetops, knolls, and the upper side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Amor soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is grayish brown loam about 13 inches thick. The substratum, to a depth of about 29 inches, is light gray loam. Below this to a depth of about 60 inches is soft bedrock. In some places fine sandy loam is throughout the profile. In other places glacial till is at a depth of 10 to 30 inches.

Typically, the Cabba soil has a surface layer of grayish brown loam about 4 inches thick. The next 6 inches also is grayish brown loam. The substratum, to a depth of about 17 inches, is pale yellow clay loam. Below this to a depth of about 60 inches is soft bedrock. In places the soft bedrock is within a depth of 10 inches.

Included with these soils in mapping are small areas of Arnegard and Daglum soils, which make up about 15 percent of the unit. The Arnegard soils do not have soft bedrock within a depth of 40 inches. Their surface layer is thicker than that of either the Amor soil or the Cabba soil. The Daglum soils have an alkali subsoil. They are on toe slopes and in drainageways.

Permeability is moderate in the Amor and Cabba soils. Available water capacity is low, and surface runoff is rapid. Organic matter content is moderate.

Most areas are used for range. The potential is fair for range, cultivated crops, windbreaks, sanitary facilities, and dwellings.

These soils are suited to cultivated crops. The hazard of water erosion is severe, however; on the Cabba soil. This hazard and the slope are the main problems in cultivated areas.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates keep the pasture or range and the soil in good condition.

The Amor soil is well suited to the trees and shrubs grown as windbreaks and environmental plantings, but

the Cabba soil is generally unsuited. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The depth to bedrock and the slope are limitations, but the bedrock is soft and can be easily excavated and the slope can be overcome by cutting and filling. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IVe.

41—Reeder loam, 1 to 3 percent slopes. This moderately deep, nearly level, well drained soil is in plane and slightly concave areas on upland benches and divides. Individual areas range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is sandy clay loam about 20 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive sandy clay loam about 6 inches thick. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Arnegard and Belfield soils, which make up about 15 percent of the unit. The Arnegard soils do not have soft bedrock within a depth of 60 inches. They are in concave areas. The Belfield soils have an alkali subsoil. They are in plane and slightly concave areas.

Permeability is moderate in the Reeder soil. Available water capacity is low, and surface runoff is medium. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIc.

41B—Reeder loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is in plane and convex areas on upland benches and divides. Individual areas range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is sandy clay loam about 14 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive sandy clay loam about 5 inches thick. Below this to a depth of 60 inches is soft bedrock. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Arnegard and Belfield soils, which make up about 15 percent of the unit. The Arnegard soils do not have soft bedrock within a depth of 40 inches. They are in concave areas. The Belfield soils have a sodic subsoil. They are in plane and slightly concave areas.

Permeability is moderate in the Reeder soil. Available water capacity is low, and surface runoff is medium. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIe.

41C—Reeder loam, 6 to 9 percent slopes. This moderately deep, moderately sloping, well drained soil is in plane and convex areas on upland benches and divides dissected by shallow to well defined drainageways. Individual areas range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is sandy clay loam about 14 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive sandy clay loam about 5 inches thick. Below this to a depth of 60 inches is soft bedrock. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Arnegard and Daglum soils, which make up about 15 percent of the unit. The Arnegard soils do not have soft

bedrock within a depth of 60 inches. They are in concave areas. The Daglum soils have an alkali subsoil. They are in slight depressions on side slopes.

Permeability is moderate in the Reeder soil. Available water capacity is low, and surface runoff is rapid. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching, grassed waterways, and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIIe.

41D—Reeder loam, 9 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is in plane and convex areas on upland benches and divides dissected by shallow to well defined drainageways. Individual areas range from 10 to 70 acres in size.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is sandy clay loam about 13 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive sandy loam about 5 inches thick. Below this to a depth of 60 inches is soft bedrock. In places the surface layer is more than 5 inches thick.

Included with this soil in mapping are small areas of Arnegard, Cabba, and Daglum soils, which make up about 15 percent of the unit. The Arnegard soils do not have soft bedrock within a depth of 60 inches. They are in concave areas. The Cabba soils are 10 to 20 inches deep over soft bedrock. They are on the tops of knolls and ridges. The Daglum soils have an alkali subsoil. They are in plane and slightly concave areas.

Permeability is moderate in the Reeder soil. Available water capacity is low, and surface runoff is rapid. Organic matter content is moderate.

Most areas are used for range. The potential is good for range and windbreaks and fair for cultivated crops, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching, grassed waterways, and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening the foundation and the basement walls. The slope is a limitation on sites for dwellings and shallow excavations, but it can be overcome by cutting and filling.

The capability subclass is IVe.

43D—Reeder extremely stony loam, 1 to 15 percent slopes. This moderately deep, well drained soil is on uplands. The surface is plane and convex. Stones that are 1 to 3 feet in diameter cover 3 to 15 percent of the surface (fig. 7). They are more numerous in the convex areas than in the plane areas. Individual areas range from about 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is sandy clay loam about 14 inches thick. It is brown in the upper part and light yellowish brown in the lower part. The substratum is pale olive sandy clay loam about 5 inches thick. Below this to a depth of 60 inches is soft bedrock. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Arnegard, Cabba, and Daglum soils, which make up 5 to 15 percent of the unit. The Arnegard soils do not have soft bedrock within a depth of 60 inches. They are in concave areas. The Cabba soils are 10 to 20 inches deep over soft bedrock. They are on the tops of ridges and knolls. The Daglum soils have an alkali subsoil. They are in plane and slightly concave areas.

Permeability is moderate in the Reeder soil. Available water capacity is low, and surface runoff is rapid. Organic matter content is moderate.

Most areas are used for range. The potential is poor for cultivated crops; fair for range, sanitary facilities, and dwellings; and good for windbreaks.

This soil is generally unsuited to cultivated crops because of the numerous stones on the surface. Removal of the stones generally is not feasible because the cost is too high.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

Figure 7.—Stones on Reeder extremely stony loam, 1 to 15 percent slopes. The stones are glacial erratics.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for buildings and sanitary facilities. It is underlain by soft bedrock, which can be easily excavated. The slope is a limitation, but it can be overcome by cutting and filling. The many large stones are a limitation on construction sites unless they are removed. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is VIIs.

44—Daglum-Rhoades silt loams, 1 to 3 percent slopes. These deep, nearly level, moderately well drained, alkali soils are on uplands, alluvial fans, and stream terraces. The surface is plane and concave. Individual areas range from 10 to more than 100 acres in size. They are 60 to 70 percent Daglum soil and 20 to 30 percent Rhoades soil. The Rhoades soil is in areas where scabby spots are evident. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Daglum soil has a surface layer of dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is silty clay about 20 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum, to a depth of about 46 inches, is light yellowish brown silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is loam. In other places the subsoil contains less clay and more silt.

Typically, the Rhoades soil has a surface layer of dark grayish brown silt loam about 4 inches thick. The subsoil is silty clay about 20 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum is about 24 inches thick. It is light yellowish brown silty clay loam in the upper part and pale olive silty clay in the lower part. Below this to a depth of about 60 inches is soft bedrock. In places the subsoil contains less clay and more silt.

Included with these soils in mapping are small areas of Belfield, Reeder, and Regent soils, which make up 10 to 15 percent of the unit. The Belfield soils are in concave areas. Their subsoil does not have the columnar structure characteristic of the subsoil of Daglum and Rhoades soils. The Reeder and Regent soils do not have an alkali subsoil. They are in convex areas.

Permeability is very slow in the Daglum and Rhoades soils. Surface runoff is slow. Available water capacity is moderate in the Daglum soil and low in the Rhoades soil. Organic matter content is moderate in both soils.

Most areas are used for range. The potential is poor for windbreaks and environmental plantings and sanitary facilities and fair for dwellings, range, and cultivated crops.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate. The depth to which roots can penetrate is restricted by the alkali subsoil. Stubble mulching and field windbreaks help to prevent excessive soil loss. Applying barnyard manure and returning crop residue to the soil increase the organic matter content, improve tilth, and conserve moisture.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing, restricted grazing during wet periods, and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suitable as sites for dwellings but are generally unsuitable as sites for sanitary facilities. In this survey area they generally are not used as septic tank absorption fields. They are underlain by soft bedrock, which can be easily excavated. The shrink-swell

potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IVs.

44C—Daglum-Rhoades silt loams, 3 to 9 percent slopes. These deep, gently sloping and moderately sloping, moderately well drained soils are on uplands, alluvial fans, and terraces dissected by shallow to well defined drainageways. The surface is plane and slightly concave. Individual areas range from 15 to more than 150 acres in size. They are about 55 to 65 percent Daglum soil and 30 to 40 percent Rhoades soil. The Rhoades soil is in areas where scabby spots are evident. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Daglum soil has a surface layer of dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is silty clay about 18 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum, to a depth of about 46 inches, is light yellowish brown silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is loam. In other places the subsoil contains less clay and more silt.

Typically, the Rhoades soil has a surface layer of dark grayish brown silt loam about 4 inches thick. The subsoil is silty clay about 18 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum is about 21 inches thick. It is light yellowish brown silty clay loam in the upper part and pale olive silty clay in the lower part. Below this to a depth of about 60 inches is soft bedrock. In places the subsoil contains less clay and more silt.

Included with these soils in mapping are small areas of Belfield, Reeder, and Regent soils, which make up 10 to 15 percent of the unit. The Belfield soils are in concave areas. Their subsoil does not have the columnar structure characteristic of the subsoil of Daglum and Rhoades soils. The Reeder and Regent soils do not have an alkali subsoil. They are in convex areas.

Permeability is very slow in the Daglum and Rhoades soils. Surface runoff is slow. Available water capacity is moderate in the Daglum soil and low in the Rhoades soil. Organic matter content is moderate in both soils.

Most areas are used for range. The potential is poor for cultivated crops, for windbreaks and environmental plantings, and for sanitary facilities and fair for dwellings and range.

These soils are generally unsuited to cultivated crops because of the hazards of soil blowing and water erosion and the alkali subsoil. A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing, restricted grazing during wet periods, and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suitable as sites for dwellings but are generally unsuitable as sites for sanitary facilities. In this survey area they generally are not used as septic tank absorption fields. They are underlain by soft bedrock, which can be easily excavated. The low strength and shrink-swell potential are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is VIs.

46B—Regent-Daglum silty clay loams, 3 to 6 percent slopes. These moderately deep and deep, gently sloping, well drained and moderately well drained soils are on uplands. Individual areas range from 15 to 60 acres in size. They are about 60 to 70 percent Regent soil and 20 to 30 percent Daglum soil. The Regent soil is in plane and slightly concave areas. The Daglum soil is in scattered micro depressions. It has an alkali subsoil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Regent soil has a surface layer of dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is grayish brown silty clay, the middle part is light brownish gray silty clay, and the lower part is light brownish gray silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is silt loam. In other places the dark colors extend to a depth of more than 16 inches.

Typically, the Daglum soil has a surface layer of dark grayish brown silty clay loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is silty clay about 20 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum, to a depth of about 46 inches, is light yellowish brown silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is silt loam. In other places the subsoil contains less clay and more silt.

Included with these soils in mapping are small areas of Rhoades soils, which make up 5 to 10 percent of the unit. These included soils have salts within a depth of 16 inches. They are in the same position on the landscape as the Daglum soil.

Permeability is slow in the Regent soil and very slow in the Daglum soil. Surface runoff is medium. Available water capacity is moderate in both soils. Organic matter content also is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for range, windbreaks, most sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of water erosion is moderate on both soils and the hazard of soil blowing is moderate on the Daglum soil. Stubble mulching and stripcropping help to prevent excessive soil loss. Growing alfalfa and managing crop residue increase the infiltration rate and improve tilth. The depth to which roots can penetrate is restricted by the alkali subsoil in the Daglum soil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Regent soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Daglum soil is generally unsuited because it has an alkali subsoil. Nearly all of the climatically adapted species can grow well on the Regent soil. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for most sanitary facilities and dwellings. They are underlain by soft bedrock, which can be easily excavated. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls. The Daglum soil is not suitable as a septic tank absorption field because it is very slowly permeable.

The capability subclass is IIIe.

46C—Regent-Daglum silty clay loams, 6 to 9 percent slopes. These moderately deep and deep, moderately sloping, well drained and moderately well drained soils are on uplands dissected by shallow drainageways. Individual areas range from 15 to 60 acres in size. They are about 60 to 70 percent Regent soil and 25 to 35 percent Daglum soil. The Regent soil is in plane and concave areas. The Daglum soil is in scattered micro depressions. It has an alkali subsoil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Regent soil has a surface layer of dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 24 inches thick. The upper part is grayish brown silty clay, the middle part is light brownish gray silty clay, and the lower part is light brownish gray silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is silt loam.

Typically the Daglum soil has a surface layer of dark grayish brown silty clay loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is silty clay about 18 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum, to a depth of about 45 inches, is light yellowish brown silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is silt loam. In other places the subsoil contains less clay and more silt.

Included with these soils in mapping are small areas of Rhoades soils, which make up 10 to 15 percent of the unit. These included soils have salts within a depth of 16 inches. They are in the same position on the landscape as the Daglum soil.

Permeability is slow in the Regent soil and very slow in the Daglum soil. Surface runoff is medium on both soils. Available water capacity is moderate. Organic matter content also is moderate.

Most areas are used for cultivated crops or for range. The potential is fair for range, cultivated crops, windbreaks, most sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of water erosion is moderate on both soils and the hazard of soil blowing is moderate on the Daglum soil. Stubble mulching and stripcropping help to prevent excessive soil loss. Growing alfalfa and managing crop residue increase the infiltration rate and improve tilth. The depth to which roots can penetrate is restricted by the alkali subsoil in the Daglum soil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Regent soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Daglum soil is generally unsuited because it has an alkali subsoil. Nearly all of the climatically adapted species can grow well on the Regent soil. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for most sanitary facilities and dwellings. The bedrock in both soils is soft and can be easily excavated. The slope is a limitation on sites for sewage lagoons, but it can be overcome by cutting and filling. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls. The Daglum soil is not suitable as a septic tank absorption field because it is very slowly permeable.

The capability subclass is IVe.

47B—Manning fine sandy loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, somewhat excessively drained soil is on stream and outwash terraces. Individual areas range from about 10 to 80 acres in size. The surface is plane and convex.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is about 15 inches thick. The upper part is dark brown loam, and the lower part is brown fine sandy loam. The upper part of the substratum is light brownish gray fine sandy loam. The middle part is light brownish gray coarse sand. The lower part to a depth of about 60 inches is light olive gray coarse sand. In places the depth to coarse sand is more than 40 inches.

Included with this soil in mapping are small areas of Parshall and Wabek soils, which make up 10 to 15 percent of the unit. The Parshall soils are dark to a depth of more than 16 inches. They are in concave areas. The Wabek soils are shallow to sand and gravel. They are in convex areas on knolls and ridgetops.

Permeability is moderately rapid in the upper part of the Manning soil and very rapid in the lower part.

Surface runoff is slow. Available water capacity is low. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for range, cultivated crops, and windbreaks and good for sanitary facilities and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe and the hazard of water erosion is moderate. Stubble mulching and stripcropping help to prevent excessive soil loss. Growing alfalfa and managing crop residue increase the organic matter content and conserve moisture.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Optimum survival, growth, and vigor are unlikely. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored by trench walls.

The capability subclass is IIIe.

49B—Telfer loamy fine sand, 1 to 6 percent slopes. This deep, nearly level and gently sloping, somewhat excessively drained soil is on plane and convex stream terraces and outwash plains. Individual areas range from 15 to several hundred acres in size.

Typically, the surface layer is dark grayish brown loamy fine sand about 11 inches thick. The next 4 inches is grayish brown loamy fine sand. The substratum to a depth of about 60 inches is light olive brown. The upper part is loamy sand, and the lower part is fine sand. In places the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Lihen, Parshall, and Seroco soils, which make up 10 to 15 percent of the unit. The Lihen soils are in plane and slightly concave areas. Their surface layer is thicker than that of the Telfer soil. The Parshall soils contain less sand and more clay than the Telfer soil. They are in concave areas. The Seroco soils do not have a dark surface layer. They are on the tops of knolls and ridges.

Permeability is rapid in the Telfer soil, and surface runoff is slow. Available water capacity is moderate. Organic matter content is low.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for windbreaks and good for range, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species are suitable for enhancing wildlife habitat and other areas and for revegetating. Optimum survival, growth, and vigor are unlikely. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored by trench walls.

The capability subclass is IVe.

51B—Noonan loam, 1 to 6 percent slopes. This deep, nearly level and undulating, well drained, alkali soil is in concave areas on uplands. Individual areas range from about 15 to 150 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is grayish brown silt loam about 3 inches thick. The subsoil is about 14 inches thick. It is dark grayish brown clay loam in the upper part and grayish brown loam in the lower part. The substratum to a depth of about 60 inches is light brownish gray clay loam. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Williams and Bearpaw soils, which make up about 10 to 15 percent of the unit. These soils do not have an alkali subsoil. They are in convex areas.

Permeability is slow in the Noonan soil. Surface runoff also is slow. Available water capacity is moderate. Organic matter content also is moderate.

Most areas are used for range or cultivated crops. The potential is fair for range, cultivated crops, dwellings, and sanitary facilities and poor for windbreaks.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching and buffer strips help to prevent excessive erosion. Growing alfalfa and managing crop residue increase the infiltration rate and improve tilth. The depth to which roots can penetrate is restricted by the alkali subsoil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing, deferred grazing in the spring, and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is generally unsuited to the trees and shrubs grown as windbreaks and environmental plantings because it has an alkali subsoil. None of the climatically adapted species can grow well.

This soil is suitable as a site for sanitary facilities and dwellings. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IVs.

53—Bearpaw silt loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is in plane and slightly convex areas on uplands. Individual areas range from 10 to 120 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is clay loam about 20 inches thick. The upper part is grayish brown, and the lower part is olive gray. The substratum to a depth of about 60 inches is clay loam. It is olive gray in the upper part and grayish brown in the lower part. In some places the dark colors extend to a depth of more than 16 inches. In other places the subsoil is loam.

Included with this soil in mapping are small areas of Niobell, Noonan, and Tonka soils, which make up about 10 to 15 percent of the unit. The Niobell and Noonan soils have an alkali subsoil. They are in concave areas. The Tonka soils are poorly drained and are in shallow depressions.

Permeability is slow in the Bearpaw soil. Surface runoff also is slow. Available water capacity is high. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range and windbreaks and fair for sanitary facilities and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and field windbreaks help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIc.

53B—Bearpaw silt loam, 3 to 6 percent slopes. This deep, undulating, well drained soil is in plane and convex areas on uplands. Individual areas range from 10 to 200 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsoil is clay loam about 24 inches thick. It is grayish brown in the upper part and olive gray in the lower part. The substratum to a depth of about 60 inches is clay loam. It is olive gray in the upper part and grayish brown in the lower part. In some places the dark colors extend to a depth of more than 16 inches. In other places the subsoil is loam.

Included with this soil in mapping are small areas of Niobell, Noonan, and Tonka soils, which make up 10 to 15 percent of the unit. The Noonan and Niobell soils have an alkali subsoil. They are in plane and concave areas. Also, the surface layer of the Niobell soils is thicker than that of the Bearpaw soil. The Tonka soils are poorly drained and are in shallow depressions.

Permeability is slow in the Bearpaw soil, and surface runoff is medium. Available water capacity is high. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range and windbreaks and fair for sanitary facilities and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and contour stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

53C—Bearpaw silt loam, 6 to 9 percent slopes. This deep, gently rolling, well drained soil is in plane and convex areas on uplands. Individual areas range from 10 to 140 acres in size and are irregular in shape. Scattered pebbles, cobblestones, and other stones are on the surface of knobs and ridges.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsoil is clay loam about 24 inches thick. It is grayish brown in the upper part and olive gray in the lower part. The substratum to a depth of about 60 inches is clay loam. It is olive gray in the upper part and grayish brown in the lower part. In

some places the surface layer is clay loam. In other places the subsoil is loam, and in a few places it has been mixed with the surface layer by plowing.

Included with this soil in mapping are small areas of Niobell, Noonan, and Zahl soils, which make up 10 to 15 percent of the unit. The Niobell and Noonan soils have an alkali subsoil. They are in concave areas. The Zahl soils are on knobs and ridges. They do not have a subsoil.

Permeability is slow in the Bearpaw soil, and surface runoff is medium. Available water capacity is high. Organic matter content is moderate.

More than half of the acreage is used as range, and the rest is used for cultivated crops. The potential is fair for cultivated crops, sanitary facilities, and dwellings and good for range and windbreaks.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching, grassed waterways, and contour stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIIe.

54—Regent silty clay loam, 1 to 3 percent slopes. This moderately deep, nearly level, well drained soil is on uplands. Individual areas range from 10 to 40 acres in size. The surface is plane and convex.

Typically, the surface layer is dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is grayish brown silty clay, the middle part is light brownish gray silty clay, and the lower part is light brownish gray silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is clay loam. In other places the dark colors extend to a depth of more than 16 inches.

Included with this soil in mapping are small areas of Belfield soils, which make up 5 to 10 percent of the unit. These soils have an alkali subsoil. They are in plane and slightly concave areas.

Permeability is slow in the Regent soil, and surface runoff also is slow. Available water capacity is moderate. Organic matter content also is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for windbreaks and fair for range, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of water erosion and soil blowing are slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation.

The capability subclass is IIc.

54B—Regent silty clay loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is on uplands. Individual areas range from 10 to 80 acres in size. The surface is plane and convex.

Typically, the surface layer is dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is grayish brown silty clay, the middle part is light brownish gray silty clay, and the lower part is light brownish gray silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is clay loam. In other places the dark colors extend to a depth of more than 16 inches.

Included with this soil in mapping are small areas of Belfield soils, which make up 10 to 15 percent of the unit. These soils have an alkali subsoil. They are in plane and slightly concave areas.

Permeability is slow in the Regent soil, and surface runoff is medium. Available water capacity is moderate. Organic matter content also is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for windbreaks and fair for range, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of water erosion is moderate. Stubble mulching and stripcropping help to prevent excessive erosion.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of

grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation.

The capability subclass is IIe.

54C—Regent silty clay loam, 6 to 9 percent slopes. This moderately deep, moderately sloping, well drained soil is on uplands dissected by shallow drainageways. Individual areas range from 10 to 60 acres in size. The surface is plane and convex.

Typically, the surface layer is dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 25 inches thick. The upper part is grayish brown silty clay, the middle part is light brownish gray silty clay, and the lower part is light brownish gray silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In some places the surface layer is clay loam. In other places the dark colors extend to a depth of more than 16 inches.

Included with this soil in mapping are small areas of Cabba and Daglum soils, which make up 10 to 15 percent of the unit. The Cabba soils are 10 to 20 inches deep over soft bedrock. They are on the tops of ridges and knolls. The Daglum soils have an alkali subsoil. They are in plane areas on side slopes.

Permeability is slow in the Regent soil, and surface runoff is medium. Available water capacity is moderate. Organic matter content also is moderate.

Most areas are used for cultivated crops or range. The potential is fair for cultivated crops and for range, sanitary facilities, and dwellings and good for windbreaks.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of water erosion is moderate. Stubble mulching, grassed waterways, and stripcropping help to prevent excessive erosion.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The slope is a limitation on sites for sewage lagoons, but it can be overcome by cutting and filling. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation.

The capability subclass is IIIe.

54D—Regent silty clay loam, 9 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on uplands dissected by shallow to well defined drainageways. Individual areas range from about 10 to 30 acres in size. The surface is convex and plane.

Typically, the surface layer is dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 23 inches thick. The upper part is grayish brown silty clay, the middle part is light brownish gray silty clay, and the lower part is light brownish gray silty clay loam. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is clay loam.

Included with this soil in mapping are small areas of Cabba and Daglum soils, which make up 10 to 15 percent of the unit. The Cabba soils are 10 to 20 inches deep over soft bedrock. They are on the tops of ridges and knolls. The Daglum soils have an alkali subsoil. They are in plane areas on side slopes.

Permeability is slow in the Regent soil, and surface runoff is rapid. Available water capacity is moderate. Organic matter content also is moderate.

Most areas are used for range. The potential is poor for cultivated crops, fair for range, sanitary facilities, and dwellings, and good for windbreaks.

This soil is generally unsuited to wheat, oats, barley, and flax. The hazard of water erosion is moderate. A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The slope is a limitation on sites for some sanitary facilities and some buildings, but it can be overcome by cutting and filling. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation.

The capability subclass is VIe.

55C—Rhoades silt loam, 1 to 9 percent slopes. This deep, nearly level to moderately sloping, moderately

well drained, alkali soil is on uplands and stream terraces that have scabby spots. Individual areas range from 15 to several hundred acres in size. The surface is plane and concave.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is silty clay about 20 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum is about 24 inches thick. It is light yellowish brown silty clay loam in the upper part and pale olive silty clay in the lower part. Below this to a depth of about 60 inches is soft bedrock. In areas that do not have a plant cover, the subsoil is exposed.

Included with this soil in mapping are small areas of Belfield, Daglum, and Reeder soils, which make up 10 to 15 percent of the unit. The well drained Belfield soils are in swales. Their surface layer is thicker than that of the Rhoades soil. The Daglum soils are in the same positions on the landscape as the Rhoades soil. Their surface soil is thicker than that of the Rhoades soil. The Reeder soils do not have an alkali subsoil. They are in convex areas.

Permeability is very slow in the Rhoades soil, and surface runoff is slow to rapid. Available water capacity is low. Organic matter content is moderate.

Most areas are used for range. The potential is poor for cultivated crops and for range, windbreaks and environmental plantings, sanitary facilities, and dwellings.

This soil is generally unsuited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Plowing results in a poor seedbed, a slow infiltration rate, and surface crusting.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing, restricted grazing during wet periods, and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is poorly suited to sanitary facilities and dwellings because of the very slow permeability, a high shrink-swell potential, and low strength. The measures needed to overcome these limitations are costly. In this survey area Rhoades soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is VIs.

58—Bowdle loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is on stream terraces and outwash plains. It is moderately deep to sand and gravel. The surface is plane or slightly concave. Individual areas range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown loam about 17 inches thick. The substratum to a depth of about 60 inches is grayish brown. The upper part is loam, and the lower part is gravelly coarse sand. In places the dark colors extend to a depth of less than 16 inches.

Included with this soil in mapping are small areas of Arnegard and Lehr soils, which make up 10 to 15 percent of the unit. The Arnegard soils do not have sand and gravel within a depth of 40 inches. They are in concave areas. The Lehr soils are less than 20 inches deep over sand and gravel. They are in convex areas on knolls and ridgetops.

Permeability is moderate in the upper part of the Bowdle soil and rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. Organic matter content also is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, sanitary facilities, and dwellings and fair for windbreaks.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. An adequate plant cover traps snow and thus increases the moisture supply.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations cave in unless they are shored.

The capability subclass is IIIs.

58B—Bowdle loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on stream terraces and outwash plains. It is moderately deep to sand and gravel. The surface is plane or slightly concave. Individual areas range from 20 to 180 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown loam about 15 inches thick. The substratum to a depth of about 60 inches is grayish brown. The upper part is loam, and the lower part is gravelly coarse sand. In places the dark colors extend to a depth of less than 16 inches.

Included with this soil in mapping are small areas of Arnegard and Lehr soils, which make up 10 to 15 percent of the unit. The Arnegard soils do not have sand and gravel within a depth of 40 inches. They are in swales and shallow depressions. The Lehr soils are less than 20 inches deep over sand and gravel. They are in convex areas on knolls and ridgetops.

Permeability is moderate in the upper loamy material of the Bowdle soil and rapid in the lower sandy material.

Surface runoff is medium. Available water capacity is moderate. Organic matter content also is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, sanitary facilities, and dwellings and fair for windbreaks.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. An adequate plant cover traps snow and thus increases the moisture supply. Also, it reduces the runoff rate.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored.

The capability subclass is IIIe.

60B—Farland silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on terraces and alluvial fans dissected by shallow drainageways. The surface is plane or convex. Individual areas range from 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 23 inches thick. The upper part is dark grayish brown and grayish brown silty clay loam, and the lower part is grayish brown clay loam and silty clay loam. The substratum to a depth of about 60 inches is silty clay loam. The upper part is olive gray, and the lower part is olive and pale olive. In some places the dark colors extend to a depth of more than 16 inches. In other places the subsoil contains less silt and more sand.

Included with this soil in mapping are small areas of Grassna and Regent soils, which make up 10 to 15 percent of the unit. The Grassna soils have a surface layer that is thicker than that of the Farland soil. They are in concave areas. The Regent soils are less than 40 inches deep over shale. They are in convex areas on knolls and ridgetops.

Permeability is moderately slow in the Farland soil. Surface runoff is medium. Available water capacity is high. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range and windbreaks and fair for sanitary facilities and dwellings.

This soil is suited to wheat, barley, oats, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

62—Amor loam, 1 to 3 percent slopes. This moderately deep, nearly level, well drained soil is in plane and slightly convex areas on upland benches and divides. Individual areas range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is grayish brown loam about 13 inches thick. The substratum, to a depth of about 29 inches, is light gray loam. Below this to a depth of about 60 inches is soft bedrock. In some areas, the dark colors extend to a greater depth and the soft bedrock is not evident within a depth of 40 inches.

Included with this soil in mapping are small areas of Belfield soils, which make up about 5 percent of the unit. These soils have an alkali subsoil. They are in plane or slightly concave areas.

Permeability is moderate in the Amor soil. Available water capacity is low, and the surface runoff is slow. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The depth to bedrock is a limitation, but the bedrock is soft and can be easily excavated. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIc.

62B—Amor loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is in plane or convex areas on upland benches and divides. Individual areas range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is grayish brown loam about 13 inches thick. The substratum, to a depth of about 29 inches, is light gray loam. Below this to a depth of about 60 inches is soft bedrock. In some areas, the dark colors extend to a greater depth and the soft bedrock is not evident within a depth of 40 inches.

Included with this soil in mapping are small areas of Belfield and Vebar soils, which make up about 5 to 10 percent of the unit. The Belfield soils have an alkali subsoil. They are in plane and slightly concave areas. The Vebar soils have a surface layer of fine sandy loam. They are on the tops of knobs and ridges.

Permeability is moderate in the Amor soil. Available water capacity is low, and surface runoff is slow. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The depth to bedrock is a limitation, but the bedrock is soft and can be easily excavated. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIe.

62C—Amor loam, 6 to 9 percent slopes. This moderately deep, moderately sloping, well drained soil is in plane and convex areas on upland benches and divides dissected by shallow to well defined drainageways. Individual areas range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is grayish brown loam about 13 inches thick. The substratum, to a depth of about 29 inches, is light gray loam. Below this to a depth of about 60 inches is soft bedrock. In places the subsoil is clay loam. In some areas, the dark colors extend to a greater depth and the soft bedrock is not evident within a depth of 40 inches.

Included with this soil in mapping are small areas of Cabba, Daglum, and Vebar soils, which make up about 15 percent of the unit. The Cabba soils are 10 to 20 inches deep over soft bedrock. They are on the tops and crests of ridges. The Daglum soils have an alkali subsoil. They are in slight depressions on side slopes. The Vebar soils have a surface layer of fine sandy loam. They are in the same positions on the landscape as the Amor soil.

Permeability is moderate in the Amor soil. Available water capacity is low, and surface runoff is medium. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching, stripcropping, and grassed waterways help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The depth to bedrock is a limitation, but the bedrock is soft and can be easily excavated. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening the foundation and the basement walls.

The capability subclass is IIIe.

62D—Amor loam, 9 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is in plane and convex areas on upland benches and divides dissected by shallow to well defined drainageways. Individual areas range from 10 to 70 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is grayish brown loam about 13 inches thick. The substratum, to a depth of about 29 inches, is light gray loam. Below this to a depth of about 60 inches is soft bedrock. In places the subsoil is clay loam.

Included with this soil in mapping are small areas of Arnegard, Cabba, and Daglum soils, which make up about 15 percent of the unit. The Arnegard soils are in swales. Their surface layer is thicker than that of the Amor soil. The Cabba soils are 10 to 20 inches deep over soft bedrock. They are on the tops of knolls and ridges. The Daglum soils have an alkali subsoil. They are in plane and slightly concave areas on side slopes.

Permeability is moderate in the Amor soil. Available water capacity is low, and surface runoff is rapid. Organic matter content is moderate.

Most areas are used for range. The potential is good for range and windbreaks and fair for cultivated crops, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is moderate and the hazard of water erosion is severe. Stubble mulching, stripcropping, and grassed waterways help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. The depth to bedrock is a limitation, but the bedrock is soft and can be easily excavated. The shrink-swell potential and low strength are limitations on sites for dwellings, but they can be overcome by strengthening the foundation and the basement walls. The slope is a limitation on sites for dwellings and shallow excavations, but it can be overcome by cutting and filling.

The capability subclass is IVe.

63D—Wabek loam, 6 to 15 percent slopes. This deep, gently rolling and rolling, excessively drained soil is on outwash plains and stream terraces. It is very shallow to sand and gravel. The surface is convex. Individual areas range from 10 to 60 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The upper part of the substratum is light brownish gray gravelly sandy loam. The lower part to a depth of about 60 inches is pale brown very gravelly coarse sand. In some areas a 1- to 3-inch subsoil is below the surface layer. In other areas the surface layer is sandy loam.

Included with this soil in mapping are small areas of Lehr, Manning, and Stady soils, which make up 10 to 15 percent of the unit. These soils are deeper to sand and gravel than the Wabek soil. The Lehr soils are in convex areas, and the Manning and Stady soils are in plane and slightly concave areas.

Permeability is very rapid in the Wabek soil, and surface runoff is slow. Available water capacity is very low. Organic matter content is low.

Most areas are used for range. The potential is poor for cultivated crops and for range and windbreaks and environmental plantings. It is fair for sanitary facilities and dwellings.

This soil is generally unsuited to cultivated crops. The hazard of erosion is too severe, and the soil is too droughty.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored. The slope is a limitation on sites for dwellings, but it can be overcome by cutting and filling.

The capability subclass is VIs.

64—Wilton silt loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is on broad flats and in long drainageways on uplands. The surface is plane and concave. Individual areas range from about 10 to more than 200 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 26 inches thick. The upper part is dark grayish brown silt loam, and the lower part is light olive brown loam. The upper part of the substratum is light brownish gray loam. The lower part to a depth of about 60 inches is pale olive clay loam. In some places the dark colors extend to a depth of less than 16 inches. In other places the depth to glacial till is more than 40 inches.

Included with this soil in mapping are small areas of Bryant and Tonka soils, which make up 5 to 10 percent of the unit. The Bryant soils do not have glacial till within a depth of 40 inches. They are in convex areas. The Tonka soils are poorly drained and are in closed depressions.

Permeability is moderately slow in the Wilton soil, and surface runoff is slow. Available water capacity is high. Organic matter content also is high.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIc.

64B—Temvik silt loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is in plane and

slightly convex areas on uplands. Individual areas range from 15 to more than 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is silt loam about 17 inches thick. The upper part is dark grayish brown, the middle part is brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is clay loam. The upper part is light brownish gray, and the lower part is light olive gray. In some places the dark colors extend to a depth of more than 16 inches. In other places the slope is less than 3 percent.

Included with this soil in mapping are small areas of Bryant, Grassna, and Williams soils, which make up 10 to 15 percent of the unit. The Bryant and Grassna soils do not have glacial till within a depth of 40 inches. The Bryant soils are in the same positions on the landscape as the Temvik soil, and the Grassna soils are in swales. The Williams soils have a clay loam subsoil. They are in convex areas on knolls, ridges, and the upper side slopes.

Permeability is moderately slow in the Temvik soil. Available water capacity is high, and surface runoff is medium. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be eliminated before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

64C—Temvik silt loam, 6 to 9 percent slopes. This deep, moderately sloping, well drained soil is in plane and slightly convex areas on uplands. Individual areas range from 10 to 120 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is silt loam about 17 inches thick. The upper part is dark grayish brown, the middle part is brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is clay loam. The upper part is light brownish gray, and the lower part is light olive gray. In places the dark colors extend to a depth of more than 16 inches.

Included with this soil in mapping are small areas of Bryant, Grassna, and Williams soils, which make up about 15 percent of the unit. The Bryant and Grassna soils do not have glacial till within a depth of 40 inches. The Bryant soils are in the same positions on the landscape as the Temvik soil, and the Grassna soils are in concave areas. The Williams soils have a clay loam subsoil. They are in convex areas on knolls, ridges, and the upper side slopes.

Permeability is moderately slow in the Temvik soil, and surface runoff is rapid. Available water capacity is high. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching and contour stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

66C—Seroco fine sand, 1 to 9 percent slopes. This deep, nearly level to gently rolling, excessively drained soil is on terraces and outwash plains. It is droughty. The surface is plane and convex. Individual areas range from 25 to several hundred acres in size.

Typically, the surface layer is grayish brown fine sand about 4 inches thick. The substratum to a depth of about 60 inches is light brownish gray fine sand. In some places a 1- to 3-inch subsoil is below the surface layer. In other places dark buried layers are at various depths.

Included with this soil in mapping are small areas of Lihen, Parshall, and Telfer soils, which make up 10 to 15 percent of the unit. The surface layer of these soils is thicker and finer textured than that of the Seroco soil. The Lihen soils are in plane areas, the Parshall soils are in concave areas, and the Telfer soils are in convex areas. Also included are areas where blowouts a half an acre to an acre in size have formed.

Permeability is rapid in the Seroco soil, and surface runoff is very slow. Available water capacity is low. Organic matter content is very low.

Most areas are used for range. The potential is poor for cultivated crops and for windbreaks and environmental plantings. It is fair for range and good for sanitary facilities and dwellings.

This soil is generally unsuited to cultivated crops. The hazard of soil blowing is severe, and the soil is too droughty.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. Because of the severe hazard of soil blowing, blowouts can form on overgrazed pastures.

This soil is suitable as a site for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The sides of shallow excavations can cave in unless they are shored.

The capability subclass is VIe.

66E—Seroco fine sand, 3 to 35 percent slopes. This deep, undulating to steep, excessively drained soil is on terraces and outwash plains. It is droughty. Individual areas range from 15 to 200 acres in size.

Typically, the surface layer is grayish brown fine sand about 4 inches thick. The substratum to a depth of about 60 inches is light brownish gray fine sand. In places a half a foot to several feet of windblown material is deposited on the surface. In some small areas windblown loose sand has formed into hummocks and dunes, which a plant cover has stabilized. In some areas dark buried layers are at various depths. In other areas unstable blowouts 1/4 acre to 10 acres in size have formed.

Included with this soil in mapping are small areas of Lihen and Telfer soils, which make up 5 to 10 percent of the unit. The surface layer of these soils is thicker and finer textured than that of the Seroco soil. The Lihen soils are in plane and concave areas, and the Telfer soils are in convex areas.

Permeability is rapid in the Seroco soil, and surface runoff is very slow. Available water capacity is low. Organic matter content is very low.

Most areas are used as range. The potential is poor for cultivated crops and for windbreaks and environmental plantings. It is fair for range, dwellings, and sanitary facilities.

This soil is generally unsuited to cultivated crops. The hazard of soil blowing is severe, and the soil is too steep and too droughty.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. Because of the severe hazard of soil blowing, blowouts can form on overgrazed pastures.

This soil is suitable as a site for sanitary facilities and dwellings. The effluent from sanitary facilities, however, can seep into ground water supplies. The slope is a limitation on sites for septic tank absorption fields, shallow excavations, and dwellings, but it can be overcome by installing the absorption field on the contour and by cutting and filling on sites for shallow excavations and dwellings. The sides of shallow excavations can cave in unless they are shored.

The capability subclass is VIIe.

67B—Vebar fine sandy loam, 1 to 6 percent slopes. This moderately deep, nearly level and gently sloping, well drained soil is on uplands dissected by shallow drainageways. The surface generally is convex. Individual areas range from 10 to 140 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsoil is fine sandy loam about 18 inches thick. The upper part is brown, and the lower part is pale brown. The substratum is light yellowish brown loamy fine sand about 8 inches thick. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is loam.

Included with this soil in mapping are small areas of Amor and Parshall soils, which make up 10 to 15 percent of the unit. The Amor soils are in positions on the landscape similar to those of the Vebar soil. They contain more clay and less sand than that soil. The Parshall soils do not have soft bedrock within a depth of 60 inches. They are in drainageways and in concave areas on foot slopes.

Permeability is moderately rapid in the Vebar soil, and surface runoff is slow. Available water capacity is low. Organic matter content also is low.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for windbreaks and good for range, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe and the hazard of water erosion is moderate. Stubble mulching, grassed waterways, and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated.

The capability subclass is IIIe.

67C—Vebar fine sandy loam, 6 to 9 percent slopes. This moderately deep, moderately sloping, well

drained soil is on uplands dissected by shallow to well defined drainageways. The surface generally is convex. Individual areas range from 10 to 240 acres in size.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The subsoil is fine sandy loam about 17 inches thick. The upper part is brown, and the lower part is pale brown. The substratum is light yellowish brown loamy fine sand about 7 inches thick. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is loam.

Included with this soil in mapping are small areas of Amor, Cohagen, and Parshall soils, which make up 10 to 15 percent of the unit. The Amor soils are in positions on the landscape similar to those of the Vebar soil. They contain more clay and less sand than that soil. The Cohagen soils are on the tops of knolls and ridges. They are 10 to 20 inches deep over soft bedrock. The Parshall soils do not have soft bedrock within a depth of 60 inches. They are in drainageways and in concave areas on foot slopes.

Permeability is moderately rapid in the Vebar soil, and surface runoff is medium. Available water capacity is low. Organic matter content also is low.

Most areas are used for range or cultivated crops. The potential is fair for cultivated crops and for windbreaks and good for range, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe and the hazard of water erosion is moderate. Stubble mulching, grassed waterways, and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated.

The capability subclass is IVe.

67D—Vebar fine sandy loam, 9 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on upland benches and divides dissected by well defined drainageways. Individual areas range from about 40 to several hundred acres in size. The surface generally is convex.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil is fine sandy loam about 16 inches thick. The upper part is brown, and the lower part is pale brown. The substratum is light yellowish brown loamy fine sand about 7 inches thick. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is loam.

Included with this soil in mapping are small areas of Amor, Cohagen, and Parshall soils, which make up 10 to 15 percent of the unit. The Amor soils are in positions on the landscape similar to those of the Vebar soil. They contain more clay and less sand than that soil. The Cohagen soils are on the tops of knolls and ridges. They are 10 to 20 inches deep over soft bedrock. The Parshall soils do not have soft bedrock within a depth of 60 inches. They are in drainageways and in concave areas on foot slopes.

Permeability is moderately rapid in the Vebar soil, and surface runoff is rapid. Available water capacity is low. Organic matter content also is low.

Most areas are used as range. The potential is poor for cultivated crops, good for range, and fair for windbreaks, sanitary facilities, and dwellings.

This soil is generally unsuited to cultivated crops. The hazard of water erosion is moderate, and the hazard of soil blowing is severe. Also, the soil is too steep.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Optimum survival, growth, and vigor are unlikely. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. It is underlain by soft bedrock, which can be easily excavated. The slope is a limitation on sites for shallow excavations and dwellings, but it can be overcome by cutting and filling.

The capability subclass is VIe.

70—Williams-Bowbells loams, 1 to 3 percent slopes. These deep, nearly level, well drained soils are on uplands. Individual areas are about 55 to 65 percent Williams soil and 20 to 30 percent Bowbells soil. The Williams soil is in plane and convex areas, and the Bowbells soil is in plane and slightly concave areas. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown clay loam about 9 inches thick. The substratum to a depth of about 60 inches is light brownish gray clay loam.

Typically, the Bowbells soil has a surface layer of dark grayish brown loam about 13 inches thick. The subsoil is clay loam about 14 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is light brownish gray clay loam.

Included with these soils in mapping are small areas of Arnegard, Parnell, and Tonka soils, which make up about

10 to 15 percent of the unit. The Arnegard soils do not have glacial till within a depth of 40 inches. They are in concave areas. The very poorly drained Parnell soils and the poorly drained Tonka soils are in depressions.

Permeability is moderately slow in the Williams and Bowbells soils, and surface runoff is slow. Available water capacity is high. Organic matter content is moderate in the Williams soil and high in the Bowbells soil.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and field windbreaks help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIc.

70B—Williams-Bowbells loams, 3 to 6 percent slopes. These deep, gently sloping, well drained soils are on uplands. Individual areas are about 45 to 55 percent Williams soil and 25 to 35 percent Bowbells soil. The Williams soil is in plane and convex areas, and the Bowbells soil is in plane and slightly concave areas. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown clay loam about 9 inches thick. The substratum to a depth of about 60 inches is light brownish gray clay loam.

Typically, the Bowbells soil has a surface layer of dark grayish brown loam about 11 inches thick. The subsoil is clay loam about 14 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is light brownish gray clay loam.

Included with these soils in mapping are small areas of Arnegard, Parnell, and Tonka soils, which make up about 10 to 15 percent of the unit. The Arnegard soils do not have glacial till within a depth of 40 inches. They are in concave areas. The very poorly drained Parnell soils and the poorly drained Tonka soils are in depressions.

Permeability is moderately slow in the Williams and Bowbells soils, and surface runoff is medium. Available water capacity is high. Organic matter content is moderate in the Williams soil and high in the Bowbells soil.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and contour stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

70C—Williams loam, 6 to 9 percent slopes. This deep, gently rolling, well drained soil is in plane and convex areas on glacial till plains. Individual areas range from 10 to more than 200 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown clay loam about 8 inches thick. The substratum to a depth of about 60 inches is light brownish gray clay loam. In places the dark colors extend to a depth of more than 16 inches.

Included with this soil in mapping are small areas of Arnegard, Parnell, Tonka, and Zahl soils, which make up 10 to 15 percent of the unit. The Arnegard soils do not have glacial till within a depth of 40 inches. They are in concave areas. The very poorly drained Parnell soils and the poorly drained Tonka soils are in depressions. The Zahl soils are on knolls and ridgetops. They do not have a subsoil.

Permeability is moderately slow in the Williams soil, and surface runoff is rapid. Available water capacity is high. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching and contour stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is suitable as a site for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

72—Williams-Reeder loams, 1 to 3 percent slopes. These deep and moderately deep, nearly level, well drained soils are on uplands. Individual areas range from about 10 to 80 acres in size. They are about 70 to 80 percent Williams soil and 10 to 20 percent Reeder soil. The Williams soil is on the plane and slightly convex mid and lower side slopes and on the broader ridgetops. The Reeder soil is on narrow ridges, sharp slope breaks, and the upper sides of drainageways. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 6 inches thick. The subsoil is clay loam about 17 inches thick. The upper part is dark grayish brown, and the lower part is light olive brown. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam. In other places the dark colors extend to a depth of more than 16 inches.

Typically, the Reeder soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is loam about 20 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive loam about 6 inches thick. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is silt loam.

Included with these soils in mapping are small areas of Arnegard soils, which make up 5 to 10 percent of the unit. These soils do not have glacial till or soft bedrock within a depth of 40 inches. They are in concave areas and drainageways.

Permeability is moderately slow in the Williams soil and moderate in the Reeder soil. Available water capacity is high in the Williams soil and low in the Reeder soil. Surface runoff is medium on both soils. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all the climatically adapted species can grow well. Grasses and weeds should be eliminated before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The Reeder soil is underlain by soft bedrock, which can be easily excavated. The moderately slow permeability in the Williams soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential of both soils is a limitation on sites for dwellings, but it can be overcome by special design of foundations and basement walls.

The capability subclass is IIc.

72B—Williams-Reeder loams, 3 to 6 percent slopes. These deep and moderately deep, gently sloping, well drained soils are on uplands. Individual areas range from about 20 to more than 100 acres in size. They are about 65 to 75 percent Williams soil and 15 to 25 percent Reeder soil. The Williams soil is on the plane and convex mid and lower side slopes and on the broader ridgetops. The Reeder soil is on narrow ridges, sharp slope breaks, and the upper sides of drainageways. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown clay loam about 9 inches thick. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam. In other places the dark colors extend to a depth of more than 16 inches.

Typically, the Reeder soil has a surface layer of dark grayish brown loam about 7 inches thick. The subsoil is loam about 16 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive loam about 6 inches thick. Below this to a depth of 60 inches is soft bedrock. In places the surface layer is silt loam.

Included with these soils in mapping are small areas of Arnegard and Vebar soils, which make up 5 to 15 percent of the unit. The Arnegard soils do not have glacial till or soft bedrock within a depth of 60 inches.

They are in concave areas and drainageways. The Vebar soils are on sharply convex slopes. They are fine sandy loam throughout.

Permeability is moderately slow in the Williams soil and moderate in the Reeder soil. Available water capacity is high in the Williams soil and low in the Reeder soil. Surface runoff is medium on both soils. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The Reeder soil is underlain by soft bedrock, which can be easily excavated. The moderately slow permeability in the Williams soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential of both soils is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

72C—Williams-Reeder loams, 6 to 9 percent slopes. These deep and moderately deep, moderately sloping, well drained soils are on uplands dissected by shallow drainageways. Individual areas range from about 20 to more than 100 acres in size. They are about 60 to 70 percent Williams soil and 20 to 30 percent Reeder soil. The Williams soil is on the plane and convex mid and lower side slopes and on the broader ridgetops. The Reeder soil is on narrow ridges, sharp slope breaks, and the upper sides of drainageways. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown clay loam about 8 inches thick. The substratum to a depth of about 60 inches is light brownish gray clay loam. In places the surface layer is silt loam.

Typically, the Reeder soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is loam about 14 inches thick. The upper part is brown, and the lower part is light yellowish brown. The substratum is pale olive loam about 5 inches thick. Below this to a depth of about 60 inches is soft bedrock. In places the surface layer is silt loam.

Included with these soils in mapping are small areas of Arnegard and Vebar soils, which make up 10 to 15 percent of the unit. The Arnegard soils do not have glacial till or soft bedrock within a depth of 60 inches. They are in concave areas and drainageways. The Vebar soils are on sharply convex slopes. They are fine sandy loam throughout.

Permeability is moderately slow in the Williams soil and moderate in the Reeder soil. Available water capacity is high in the Williams soil and low in the Reeder soil. Surface runoff is rapid on both soils. Organic matter content is moderate.

Most areas are used for range. The potential is fair for cultivated crops and good for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazards of soil blowing and water erosion are moderate. Stubble mulching, grassed waterways, and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all of the climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The Reeder soil is underlain by soft bedrock, which can be easily excavated. The moderately slow permeability in the Williams soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential of both soils is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

73C—Williams-Zahl loams, 6 to 9 percent slopes. These deep, moderately sloping, well drained soils are on uplands dissected by shallow drainageways. Slopes are mainly linear and convex. Individual areas range from about 10 to 70 acres in size. They are 60 to 70 percent Williams soil and 25 to 35 percent Zahl soil. The Williams soil is on the plane and convex mid and lower side slopes and on the broader ridgetops. The Zahl soil is on narrow ridges, sharp slope breaks, and the upper sides of drainageways. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown clay loam about 9 inches

thick. The substratum to a depth of about 60 inches is light brownish gray clay loam. In places the dark colors extend to a depth of more than 16 inches.

Typically, the Zahl soil has a surface of dark grayish brown loam about 6 inches thick. The substratum to a depth of about 60 inches is loam. The upper part is grayish brown, and the lower part is light olive brown. In places the surface layer is not dark.

Included with these soils in mapping are small areas of Arnegard and Parnell soils, which make up 5 to 10 percent of the unit. The Arnegard soils do not have glacial till within a depth of 40 inches. They are in concave areas. The Parnell soils are very poorly drained and are in shallow depressions.

Permeability is moderately slow in the Williams and Zahl soils, and surface runoff is rapid. Available water capacity is high. Organic matter content is moderate.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and windbreaks and good for range, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of water erosion is moderate on both soils and the hazard of soil blowing is moderate on the Williams soil and severe on the Zahl soil. Stubble mulching, grassed waterways, and stripcropping help to prevent excessive soil loss. Growing alfalfa and managing crop residue increase the infiltration rate and improve tilth.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Williams soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Zahl soil is poorly suited. Nearly all the climatically adapted species can grow well on the Williams soil. On the Zahl soil, a few of the climatically adapted species can be grown to enhance wildlife habitat and recreation and other areas. Optimum survival, growth, and vigor, however, are unlikely. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIIe.

73E—Williams-Zahl loams, 9 to 25 percent slopes. These deep, strongly sloping and moderately steep, well drained soils are on uplands dissected by shallow to well defined drainageways. Slopes are mainly linear and convex. Individual areas range from 10 to about 50 acres in size. They are 50 to 60 percent Williams soil and 35 to 45 percent Zahl soil. The Williams soil is on the plane and convex mid and lower side slopes and on the broader ridgetops. The Zahl soil is on narrow ridges, sharp slope breaks, and the upper sides of drainageways. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown clay loam about 8 inches thick. The substratum to a depth of about 60 inches is light brownish gray clay loam. In places the dark colors extend to a depth of more than 16 inches.

Typically, the Zahl soil has a surface layer of dark grayish brown loam about 6 inches thick. The substratum to a depth of about 60 inches is loam. The upper part is grayish brown, and the lower part is olive brown. In places the surface layer is not dark.

Included with these soils in mapping are small areas of Arnegard and Parnell soils, which make up 5 to 10 percent of the unit. The Arnegard soils do not have glacial till within a depth of 40 inches. They are in concave areas. The Parnell soils are very poorly drained and are in shallow depressions.

Permeability is moderately slow in the Williams and Zahl soils, and surface runoff is rapid. Available water capacity is high. Organic matter content is moderate.

Most areas are used for range. The potential is poor for cultivated crops, fair for sanitary facilities, dwellings, and windbreaks, and good for range.

These soils are generally unsuited to cultivated crops. The hazard of erosion is severe, and the soils are too steep.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

The Williams soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but the Zahl soil is poorly suited. All climatically adapted species can grow well on the Williams soil. On the Zahl soil, a few of the climatically adapted species can be grown to enhance wildlife habitat and recreation and other areas. Optimum survival, growth, and vigor, however, are unlikely. Grasses and weeds should be eliminated before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. The slope is a limitation on sites for septic tank absorption fields, shallow excavations, and dwellings. It can be overcome, however, by installing the absorption field on the contour and by cutting and filling on sites for shallow excavations and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is VIe.

79D—Telfer-Flasher loamy fine sands, 6 to 15 percent slopes. These deep and shallow, moderately sloping and strongly sloping, somewhat excessively drained soils are on uplands dissected by shallow to well defined drainageways. Individual areas are irregular and linear in shape and range from about 15 to more than 150 acres in size. They are about 60 to 70 percent Telfer soil and 20 to 30 percent Flasher soil. The Telfer soil is on the plane and slightly convex mid and lower side slopes. The Flasher soil is on knolls, ridges, and convex slopes adjacent to drainageways. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Telfer soil has a surface layer of dark grayish brown loamy fine sand about 9 inches thick. The substratum to a depth of about 60 inches is loamy fine sand. The upper part is grayish brown, and the lower part is light olive brown. In some places the surface layer is fine sandy loam. In other places soft bedrock is 40 to 60 inches from the surface.

Typically, the Flasher soil has a surface layer of dark grayish brown loamy fine sand about 5 inches thick. The substratum, to a depth of about 14 inches, is light brownish gray fine sand. Below this to a depth of about 60 inches is soft bedrock.

Included with these soils in mapping are small areas of Cohagen, Parshall, and Vebar soils, which make up 10 to 15 percent of the unit. The Cohagen and Vebar soils contain more silt and clay and less sand than the Telfer and Flasher soils. They are in convex areas. The Parshall soils are along drainageways and on foot slopes. They are fine sandy loam throughout. Their surface soil is thicker than that of the Telfer and Flasher soils.

Permeability is rapid in the Telfer and Flasher soils, and surface runoff is medium. Available water capacity is moderate in the Telfer soil and very low in the Flasher soil. Organic matter content is low in both soils.

Most areas are used for range. The potential is poor for cultivated crops and for windbreaks and environmental plantings and fair for range, sanitary facilities, and dwellings.

These soils are generally unsuited to cultivated crops. The hazard of erosion is severe, and the soils are too steep.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suitable as sites for sanitary facilities and dwellings. The Flasher soil is underlain by soft bedrock, which can be easily excavated. The slope can be overcome by cutting and filling.

The capability subclass is VIe.

79E—Flasher-Telfer loamy fine sands, 15 to 35 percent slopes. These shallow and deep, moderately steep and steep, somewhat excessively drained soils are on uplands dissected by well defined drainageways. Individual areas are linear in shape and range from 50 to more than 200 acres in size. They are about 55 to 65 percent Flasher soil and 25 to 35 percent Telfer soil. The steep Flasher soil is on knolls, ridges, and convex slopes adjacent to stream valleys. The moderately steep Telfer soil is in plane and slightly convex areas on the mid and lower side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Flasher soil has a surface layer of dark grayish brown loamy fine sand about 5 inches thick. The substratum, to a depth of about 14 inches, is light brownish gray fine sand. Below this to a depth of about 60 inches is soft bedrock.

Typically, the Telfer soil has a surface layer of dark grayish brown loamy fine sand about 8 inches thick. The substratum to a depth of about 60 inches is loamy fine sand. The upper part is grayish brown, and the lower part is light olive brown. In some places the surface layer is fine sandy loam. In other places soft bedrock is 40 to 60 inches from the surface.

Included with these soils in mapping are small areas of Cohagen, Parshall, and Vebar soils, which make up 10 to 15 percent of the unit. The Cohagen and Vebar soils contain more silt and clay and less sand than the Flasher and Telfer soils. They are in convex areas. The Parshall soils are along drainageways and on foot slopes. They are fine sandy loam throughout. Their surface soil is more than 16 inches thick.

Permeability is rapid in the Flasher and Telfer soils, and surface runoff is medium. Available water capacity is moderate in the Telfer soil and very low in the Flasher soil. Organic matter content is low in both soils.

Most areas are used as range. The potential is fair for range and poor for cultivated crops and for windbreaks and environmental plantings, sanitary facilities, and dwellings.

These soils are generally unsuited to cultivated crops. The hazard of erosion is severe, and the soils are too steep.

A cover of range or pasture plants is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are poorly suited to sanitary facilities and dwellings because the Flasher soil is shallow over soft bedrock and steep and the Telfer soil is moderately steep. The measures needed to overcome these limitations are costly. The soils generally are not used as building sites. Better sites are generally nearby.

The capability subclass is VIIe.

82—Arveson loam. This deep, level, poorly drained soil is in shallow basins, in swales, and along streams. It is commonly ponded during snowmelt and during periods of heavy rainfall. The surface is plane or concave. Individual areas range from 10 to more than 80 acres in size.

Typically, the surface layer is very dark gray loam about 7 inches thick. The next 7 inches also is very dark gray loam. The substratum is about 33 inches thick. The upper part is light brownish gray fine sandy loam and loamy fine sand, and the lower part is light gray fine sandy loam. Below this to a depth of 60 inches is a buried surface layer of dark gray silty clay. In some places the soil contains more silt and less sand. In other places it contains more clay and less sand.

Included with this soil in mapping are small areas of Lehr and Stady soils, which make up 10 to 15 percent of the unit. These soils are on knobs and ridges. The Lehr soils are somewhat excessively drained, and the Stady soils are well drained.

Permeability is moderately rapid in the Arveson soil, and surface runoff is very slow. Available water capacity is moderate. The soil has a seasonal high water table. Organic matter content is high.

Most areas are used for hay. The potential is good for range, fair for cultivated crops, and poor for windbreaks, sanitary facilities, and dwellings.

If drained, this soil is suited to wheat, oats, barley, flax, grasses, and legumes. Suitable outlets for drainage, however, generally are not available. As a result, few areas are drained. In the undrained areas, wetness usually delays tillage and seeding. The hazard of water erosion is slight, and the hazard of soil blowing is severe. Stubble mulching helps to prevent excessive soil loss.

A cover of pasture or range plants or of hay is effective in controlling erosion. Uniform distribution of grazing, deferred grazing while the soil is wet, and proper stocking rates help to keep the pasture or range and the soil in good condition.

If drained, this soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. In undrained areas, however, it is generally unsuited. All climatically adapted species can grow well in the drained areas. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

This soil is poorly suited to sanitary facilities and dwellings because it has a high water table and is subject to ponding. The measures needed to overcome these limitations are costly. In this survey area Arveson soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is Vw.

84—Havrelon Variant silt loam. This deep, level, somewhat poorly drained soil is on bottom land. It is commonly flooded. Individual areas range from about 50 to 300 acres in size.

Typically, the surface layer is about 9 inches thick. The upper part is light brownish gray silt loam, and the lower part is grayish brown silty clay loam. The upper part of the substratum is light yellowish brown silt loam. The middle part is light yellowish brown very fine sandy loam. The lower part to a depth of about 60 inches is light gray sand. In places the sand is within a depth of 40 inches.

Included with this soil in mapping are small areas of Banks Variant and Lallie soils, which make up about 15 percent of the unit. The Banks Variant contains more sand than the Havrelon soil. The Lallie soils are poorly drained.

Permeability is moderate in the Havrelon soil, and available water capacity is high. Surface runoff is slow. Organic matter content is low.

Most areas are used as wildlife habitat. The potential is good for cultivated crops and for range and windbreaks. It is poor for buildings and sanitary facilities.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is slight. Stubble mulching and crop residue management improve tilth, increase the content of organic matter, and help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range in good condition and protect the soil from erosion.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. Most of the climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is generally unsuitable as a site for sanitary facilities and dwellings because it is wet and is subject to flooding. Generally, better sites are on nearby uplands that are not flooded.

The capability subclass is IIw.

85—Hamerly loam, 1 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on uplands. The surface is plane or slightly concave. Individual areas range from 10 to 60 acres in size.

Typically, the surface layer is very dark gray loam about 8 inches thick. The next 5 inches is gray loam. The substratum to a depth of about 60 inches is loam. It is light brownish gray in the upper part, light yellowish brown in the middle part, and light gray in the lower part.

Included with this soil in mapping are small areas of Parnell, Williams, and Tonka soils, which make up 5 to 15 percent of the unit. The Parnell and Tonka soils do not have a calcareous layer within a depth of 16 inches. They are in the lower lying depressional areas. The Williams soils are well drained and are in the higher convex areas.

Permeability is moderately slow in the Hamerly soil, and surface runoff is slow. Available water capacity is high. The soil has a seasonal high water table. Organic matter content is high.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for range and windbreaks and poor for sanitary facilities and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. Stubble mulching helps to prevent excessive soil loss. Wetness delays tillage and seeding in some years.

A cover of pasture or range plants or of hay is effective in controlling erosion. Proper stocking rates, uniform distribution of grazing, and deferred grazing while the soil is wet help to keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established. A drainage system is beneficial.

This soil is generally unsuitable as a site for sanitary facilities and dwellings because it has a high water table and is wet. The measures needed to overcome these limitations are costly. In this survey area Hamerly soils are generally not used as building sites. Better sites are generally nearby.

The capability subclass is IIe.

88—Lallie silt loam. This deep, level, poorly drained soil is on bottom land. It is frequently flooded. Individual areas range from about 20 to more than 100 acres in size.

Typically, the surface layer is grayish brown silt loam about 2 inches thick. The substratum to a depth of about 60 inches is multicolored silt loam and silty clay. In places the surface layer is more than 2 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained soils that have a surface layer of sandy loam to silty clay loam. These soils make up about 15 percent of the unit.

Permeability is slow in the Lallie soil. Surface runoff also is slow. Available water capacity is high. Organic matter content is low.

Most areas are used as wildlife habitat. The potential is poor for cultivated crops and for windbreaks, dwellings, and sanitary facilities and fair for range.

This soil is generally unsuitable for cultivation because it is wet and is subject to flooding. It is best suited to range and to wetland wildlife habitat.

This soil is generally unsuitable as a site for sanitary facilities and dwellings because of the wetness and the flooding. Generally, better sites are on nearby uplands that are not flooded.

The capability subclass is Vw.

93B—Ekalaka fine sandy loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained, alkali soil is in plane and concave areas on terraces, alluvial fans, and uplands. Individual areas are irregular in shape and range from 10 to 120 acres in size.

Typically, the surface layer is fine sandy loam about 12 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The subsurface layer is light brownish gray fine sandy loam about 4 inches thick. The subsoil is about 13 inches thick. It is light brownish gray. The upper part is loam, and the lower part is fine sandy loam. The substratum to a depth of about 60 inches is light yellowish brown sandy loam.

Included with this soil in mapping are small areas of Daglum, Lihen, and Parshall soils, which make up 10 to 15 percent of the unit. The Daglum soils contain more clay and less sand than the Ekalaka soil. They are in concave areas. The Lihen and Parshall soils do not have an alkali subsoil. Their surface soil is thicker and darker than that of the Ekalaka soil. The Lihen soils are in convex and plane areas, and the Parshall soils are in concave areas.

Permeability is slow in the Ekalaka soil. Surface runoff also is slow. Available water capacity is low. Organic matter content is moderate.

Most areas are used for range. The potential is poor for windbreaks and environmental plantings, fair for range and cultivated crops, and good for sanitary facilities and dwellings.

This soil is suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of soil blowing is severe. Stubble mulching and field windbreaks help to prevent excessive soil loss. Applying barnyard manure and returning crop residue to the soil improve tilth, increase the content of organic matter, and conserve moisture. The depth to which roots can penetrate is restricted by the alkali subsoil.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

This soil is suitable as a site for sanitary facilities and dwellings. The slow permeability is a limitation in septic tank absorption fields. Enlarging the field helps to overcome this limitation.

The capability subclass is IVe.

98—Banks Variant very fine sandy loam. This deep, nearly level, somewhat poorly drained soil is on bottom land. It is frequently flooded. Individual areas range from about 50 to 200 acres in size.

Typically, the surface layer is light brownish gray very fine sandy loam about 7 inches thick. The substratum extends to a depth of more than 60 inches. It is light brownish gray. The upper part is fine sand, and the lower part is loamy very fine sand and fine sandy loam. In some places the surface layer is more than 7 inches thick. In other places it is sand, sandy loam, or loamy fine sand.

Included with this soil in mapping are small areas of Havrelon Variant and Lallie soils, which make up about 10 to 15 percent of the unit. The Lallie soils are poorly drained. The Havrelon Variant contains less sand than the Banks soil.

Permeability is rapid in the Banks soil. Available water capacity is low, and surface runoff is slow. Organic matter content is low.

Most areas are used as wildlife habitat. The potential is poor for sanitary facilities and dwellings, good for range, and fair for windbreaks and cultivated crops.

This soil is suited to wheat, oats, barley, grasses, and legumes, but the hazard of soil blowing is severe and the soil is droughty. Stubble mulching and stripcropping help to control soil blowing.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates keep the pasture or range and the soil in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and environmental plantings, but only a few of the climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

This soil is generally unsuitable as a site for sanitary facilities and dwellings because it is wet and subject to flooding. Generally, better sites are on nearby uplands that are not flooded.

The capability subclass is IVe.

162—Omio-Grassna silt loams, 0 to 3 percent slopes. These level and nearly level, moderately deep and deep, well drained soils are on smooth flats on upland benches and divides and in long drainageways. Individual areas are 65 to 75 percent Omio soil and 15 to 25 percent Grassna soil. The Omio soil is in plane and slightly concave areas, and the Grassna soil is in concave areas. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Omio soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is silt loam about 21 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum, to a depth of 38 inches, is silt loam. The upper part is light yellowish brown, and the lower part is olive. Below this to a depth of about 60 inches is soft bedrock. In places thin strata of glacial till are 30 to 40 inches from the surface.

Typically, the Grassna soil has a dark grayish brown silt loam surface layer about 9 inches thick. The subsurface layer also is dark grayish brown silt loam about 9 inches thick. The subsoil is grayish brown silt loam about 16 inches thick. The substratum to a depth of about 60 inches is light yellowish brown silt loam. In places soft bedrock is 40 to 60 inches from the surface.

Included with these soils in mapping are small areas of Amor soils, which make up 5 to 10 percent of the unit. These included soils contain less silt and more sand than the Omio and Grassna soils. They are in convex and plane areas.

Permeability is moderately slow in the Omio soil and moderate in the Grassna soil. Surface runoff is slow on both soils. Available water capacity and organic matter content are moderate in the Omio soil and high in the Grassna soil.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, sanitary facilities, and dwellings and fair for windbreaks.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. An adequate plant cover traps snow and thus increases the moisture supply.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. All climatically adapted species can be grown, but optimum survival, growth, and vigor are unlikely. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The Omio soil is underlain by soft bedrock, which can be easily excavated. The shrink-swell potential of the Grassna soil is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls. The moderate or moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field.

The capability subclass is IIc.

162B—Omio-Amor silt loams, 3 to 6 percent slopes. These gently sloping, moderately deep, well drained soils are in smooth areas on upland benches and divides. Individual areas are about 60 to 70 percent Omio soil and 20 to 30 percent Amor soil. The Omio soil is in plane and slightly concave areas. The Amor soil is in convex areas on the upper side slopes and on ridges and knolls. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Omio soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is silt loam about 19 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum is silt loam about 12 inches thick. The upper part is light yellowish brown, and the lower part is olive. Below this to a depth of about 60 inches is soft bedrock. In places thin strata of glacial till are 30 to 40 inches from the surface.

Typically, the Amor soil has a surface layer of dark grayish brown silt loam about 6 inches thick. The subsoil is grayish brown loam about 14 inches thick. The substratum is light gray loam about 6 inches thick. Below this to a depth of about 60 inches is soft bedrock.

Included with these soils in mapping are small areas of Grassna soils, which make up 5 to 10 percent of the unit. These included soils are in concave areas. They are dark to a depth of more than 16 inches.

Permeability is moderately slow in the Omio soil and moderate in the Amor soil. Surface runoff is medium on

both soils. Available water capacity is moderate in the Omio soil and low in the Amor soil. Organic matter content is moderate in both soils.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, sanitary facilities, and dwellings and fair for windbreaks.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition. An adequate plant cover traps snow and thus increases the moisture supply. It also reduces the runoff rate.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all of the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. They are underlain by soft bedrock, which can be easily excavated. The shrink-swell potential and low strength of the Amor soil are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls. The moderately slow permeability of the Omio soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field.

The capability subclass is IIe.

162C—Omio-Amor silt loams, 6 to 9 percent slopes. These moderately sloping, moderately deep, well drained soils are on upland benches and divides. Individual areas are about 55 to 65 percent Omio soil and 25 to 35 percent Amor soil. The Omio soil is in plane and slightly convex areas. The Amor soil is in convex areas on the upper side slopes and on ridges and knolls. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Omio soil has a surface layer of dark grayish brown silt loam about 5 inches thick. The subsoil is silt loam about 17 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum is silt loam about 16 inches thick. The upper part is light yellowish brown, and the lower part is olive. Below this to a depth of about 60 inches is soft bedrock. In places thin strata of glacial till are 30 to 40 inches from the surface.

Typically, the Amor soil has a surface layer of dark grayish brown silt loam about 6 inches thick. The subsoil is grayish brown loam about 11 inches thick. The substratum is light gray loam about 6 inches thick. Below this to a depth of about 60 inches is soft bedrock.

Included with these soils in mapping are small areas of Grassna soils, which make up 5 to 10 percent of the unit. These included soils are in concave areas. They are dark to a depth of more than 16 inches.

Permeability is moderately slow in the Omio soil and moderate in the Amor soil. Surface runoff is medium on both soils. Available water capacity is moderate in the Omio soil and low in the Amor soil. Organic matter content is moderate in both soils.

Most areas are used for cultivated crops. The potential is fair for cultivated crops and for windbreaks and good for range, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes, but the hazard of water erosion is moderate. Stubble mulching and stripcropping help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all of the climatically adapted species can grow well. Grasses and weeds should be removed before trees are planted and should be controlled after the trees are established.

These soils are suitable as sites for sanitary facilities and dwellings. They are underlain by soft bedrock, which can be easily excavated. The slope is a limitation on sites for some sanitary facilities and some buildings, but it can be overcome by cutting and filling. The shrink-swell and low strength of the Amor soil are limitations on sites for dwellings, but they can be overcome by strengthening foundations and basement walls. The moderately slow permeability of the Omio soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field.

The capability subclass is IIIe.

164—Williams-Falkirk loams, 1 to 3 percent slopes. These deep, nearly level, well drained soils are on uplands. Individual areas range from about 40 to several hundred acres in size. They are about 50 to 60 percent Williams soil and 30 to 40 percent Falkirk soil. The Williams soil is on ridgetops and the upper side slopes. The Falkirk soil is on the lower side slopes and in slight swales. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown clay loam about 17 inches thick. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam. In other places the dark colors extend to a depth of more than 16 inches.

Typically, the Falkirk soil has a surface layer of dark grayish brown loam about 7 inches thick. The subsoil is loam about 15 inches thick. The upper part is dark grayish brown, and the lower part is brown. The upper part of the substratum is brown loamy fine sand. The

lower part to a depth of about 60 inches is light brownish gray loam. In places the surface layer is silt loam.

Included with these soils in mapping are small areas of Stady and Lehr soils, which make up about 10 to 20 percent of the unit. These included soils are on knolls and ridgetops and along drainageways. The Stady soils are 20 to 40 inches deep over sand and gravel, and the Lehr soils are 14 to 20 inches deep over sand and gravel.

Permeability is moderately slow in the Williams and Falkirk soils, and surface runoff is medium. Available water capacity is high. Organic matter content is moderate in the Williams soil and high in the Falkirk soil.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazard of soil blowing is moderate. Stubble mulching and buffer strips help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIc.

164B—Williams-Falkirk loams, 3 to 6 percent slopes. These deep, undulating, well drained soils are on glacial till plains. Individual areas range from about 40 to several hundred acres in size. They are about 55 to 65 percent Williams soil and 20 to 30 percent Falkirk soil. The Williams soil is on ridgetops and the upper side slopes. The Falkirk soil is on the lower side slopes and in slight swales. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Williams soil has a surface layer of very dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown clay loam about 9 inches thick. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam. In other places the dark colors extend to a depth of more than 16 inches.

Typically, the Falkirk soil has a surface layer of dark grayish brown loam about 7 inches thick. The subsoil is loam about 15 inches thick. The upper part is dark grayish brown, and the lower part is brown. The upper part of the substratum is brown loamy fine sand. The lower part to a depth of about 60 inches is light brownish gray loam. In places the surface layer is silt loam.

Included with these soils in mapping are small areas of Stady and Lehr soils, which make up about 10 to 20 percent of the unit. These included soils are on knolls and ridgetops and along drainageways. The Stady soils are 20 to 40 inches deep over sand and gravel, and the Lehr soils are 14 to 20 inches deep over sand and gravel.

Permeability is moderately slow in the Williams and Falkirk soils, and surface runoff is medium. Available water capacity is high. Organic matter content is moderate in the Williams soil and high in the Falkirk soil.

Most areas are used for cultivated crops. The potential is good for cultivated crops and for range, windbreaks, sanitary facilities, and dwellings.

These soils are suited to wheat, oats, barley, flax, grasses, and legumes. The hazards of soil blowing and water erosion are moderate. Stubble mulching and field windbreaks help to prevent excessive soil loss.

A cover of range or pasture plants or of hay is effective in controlling erosion. Uniform distribution of grazing and proper stocking rates help to keep the pasture or range and the soil in good condition.

These soils are suited to the trees and shrubs grown as windbreaks and environmental plantings. Nearly all the climatically adapted species can grow well. Grasses and weeds should be removed before the trees are planted and should be controlled after a windbreak is established.

These soils are suitable as sites for sanitary facilities and dwellings. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. The shrink-swell potential is a limitation on sites for dwellings, but it can be overcome by strengthening foundations and basement walls.

The capability subclass is IIe.

Use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and pasture

Edward Weimer, agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 463,000 acres in Emmons County was used for crops and hay in 1977, according to the North Dakota Crop and Livestock Statistics for May 1978. Of this total, 117,000 acres was used for hay; 28,300 acres for row crops, mainly corn; and 317,700 acres for close-grown crops, mainly wheat, barley, oats, and flax. About 57,000 acres was summer fallowed.

The acreage of close-grown crops is increasing and the acreage of pasture, row crops, and summer fallow is decreasing, mainly as a result of grain prices.

Wheat, barley, oats, flax, legumes, and tame grasses generally are suited to the soils and climate in the county and are grown in many areas. Potatoes, sunflowers, and buckwheat are generally suitable but are not commonly grown.

The potential of the soils in Emmons County for increased production of food and fiber is good. Production could be increased by extending the latest crop production technology to all cropland in the county. This soil survey can facilitate the application of such technology.

The main concerns in managing cropland and pasture are controlling soil blowing and water erosion, conserving moisture, and maintaining fertility.

Soil blowing is a hazard on nearly all soils in the county but is most severe on Flaxton, Krem, Lihen, Parshall, Seroco, Telfer, and Vebar soils. It can damage the soils in a very short time if winds are strong and the soils are dry and have no plant cover or surface mulch. Water erosion is a hazard on the gently rolling or steeper soils, such as Amor, Bryant, Omio, Reeder, Regent, Sutley, Temvik, Williams, and Zahl soils. Cover crops, stripcropping, buffer strips, windbreaks, contour tillage, diversions and waterways, minimum tillage, timely and emergency tillage, grasses and legumes in the cropping system, and crop residue management help to control soil blowing and water erosion. A combination of these generally is used.

Soil moisture generally is conserved by measures that decrease the evaporation rate and the runoff rate, increase the infiltration rate, and control weeds. Stubble mulching, contour tillage, stripcropping, field windbreaks, buffer strips, timely tillage, minimum tillage, grasses and legumes in the cropping system, crop residue on the surface, applications of fertilizer, and summer fallowing conserve moisture. Summer fallowing also helps to control weeds.

Fertility can be improved by applying fertilizer, plowing green manure and barnyard manure under, planting cover crops, including grasses and legumes in the cropping system, and summer fallowing. Most of the measures that help to control soil blowing and water erosion also improve fertility.

To offset the effects of unfavorable soil characteristics, artificial drainage, stone removal, and reduction of salinity are needed on some soils. In most areas of the somewhat poorly to very poorly drained soils, an artificial drainage system can improve productivity and increase the number of suitable crops. In many areas, however, suitable outlets are not available. Measures that remove at least some stones generally are needed on soils that formed partly or entirely in glacial till, such as Williams and Falkirk soils. Avoiding summer fallow, growing the most salt tolerant grain crops, planting green manure crops, and growing suitable legumes and grasses improve the suitability of saline soils for crops and pasture.

Some of the measures that conserve soil and water also improve tilth. Planting green manure crops and including grasses and legumes in the cropping system are examples.

Further information about the management and the crops described in this section can be obtained from

local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Rangeland

H. Dee Galt, range conservationist, Soil Conservation Service, prepared this section.

About 30 percent of Emmons County is range. Almost half of the farm and ranch income is derived from livestock, principally cattle. On most of the farms and ranches where livestock is raised, grain is grown. The farms and ranches where cattle are raised are mainly cow-calf-yearling enterprises. Pastures of introduced crested wheatgrass or smooth brome are grazed in the spring on some of the farms and ranches. Typically, the cattle graze range and pasture during spring, summer,

and fall. They are fed from about December to April or May. The average size of the farms and ranches is about 1,500 acres.

Most of the range is in the extreme western part of the county, along the Missouri River. In the east-central part, an area the size of a township is used for range. Generally, the soils used for range are best suited to grazing or hay because they are shallow, sandy, steep, excessively stony, alkali or saline affected, or wet.

According to the Conservation Needs Inventory for 1970, improvement is needed on about 53 percent of the range. Range that has been depleted by continued heavy grazing produces only about a third of the vegetation originally produced. The taller grasses have been replaced by short grasses and by weeds. Mid grasses, such as western wheatgrass, green needlegrass, and needleandthread, could be grown in these areas. Tall grasses, such as big bluestem and switchgrass, are naturally dominant on the Overflow range sites. Productivity can be increased by measures that improve the range, such as brush control, range seeding, contour furrowing, and chiseling.

In the northwestern and southwestern parts of the county, the soils commonly are sodium or salt affected and have a dense claypan subsoil. On the Claypan and Thin Claypan range sites, potential productivity is low because the root zone is shallow and the amount of moisture available to plants is limited.

In the western and southwestern parts of the county, large areas of deep, sandy soils are subject to soil blowing. These soils, which are assigned to Thin Sands and Sandy range sites, generally support grass. Although the hazard of soil blowing is severe, the potential productivity of these sandy soils is comparable to that of other deep grassland soils if the site is well managed.

In about half of the areas used as range in the western part of the county, the soils are shallow or moderately deep and have an average slope of 6 to 25 percent. The potential productivity is lower on these soils than on deeper soils because of a lower available water capacity. Because of the slope, attaining a uniform distribution of grazing is more difficult.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for many soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Native woods and windbreaks and environmental plantings

Elmer R. Umland, forester, Soil Conservation Service, helped prepare this section.

About 3,000 acres in Emmons County is native woodland. Of this total, about 1,100 acres is near the Oahe Reservoir, on the bottom land along the Missouri River. The bottom land is flooded during periods when the water level of the river is high. The principal trees and shrubs in this area are cottonwood, green ash, dogwood, and willow.

The other woodland in the county occurs as 700 acres of Straw soils along Beaver Creek; 100 acres of Bryant soils in the uplands adjacent to the Missouri River; and 1,100 acres of the Cabba, Vebar, Amor, and Cohagen soils in the coulees leading into the Missouri River and in other creeks throughout the county. The native trees and shrubs include American elm, boxelder, cottonwood, chokecherry, juneberry, dogwood, bur oak, and willow along Beaver Creek; buffaloberry, chokecherry, green ash, and American elm in the uplands; and bur oak, green ash, buffaloberry, and juneberry on the bottom of the coulees and creeks.

During the early settlement of Emmons County, trees were used for fuel, fenceposts, and building material. The demand for trees for fuel is increasing because of the energy crisis, but the principal current uses are for erosion control, livestock protection, enhancement of wildlife habitat and recreation areas, esthetic purposes, watershed protection, and protection of homes, gardens, and crops.

Windbreaks have been planted since the days of the early settlers. Most were field and farmstead windbreaks. Some were established after the cottonwood, willow, and other seedlings on the bottom land along the Missouri River were secured. Others were established by personnel of the Mandan Experiment Station around 1920. Since that time local farmers have planted nearly 3,000,000 trees and shrubs on more than 3,900 acres. In recent decades, they have been assisted in this work by the Soil Conservation Service and the Emmons County Soil Conservation District.

Windbreaks are still needed around many farmsteads, but the major needs are for field windbreaks in cultivated areas where the hazard of soil blowing is severe and for plantings that protect livestock in feedlots and on pasture and range.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, keep snow from blowing off the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and plantings and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

Erling Podoll, biologist, Soil Conservation Service, helped prepare this section.

The major recreational developments in the survey area are near the Oahe Reservoir and in Seeman Park. All other recreational areas have limited facilities. Undeveloped land is available for public use throughout the county. These areas are used for hiking, cross-country skiing, birding, photography, and hunting.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife habitat

Erling Podoll, biologist, Soil Conservation Service, helped prepare this section.

The wildlife and fish in Emmons County provide opportunities for hunting, fishing, birding, and photography. Some of these activities stimulate the local economy.

The wildlife population has declined in this century, and the number of species has declined slightly. The quality of the habitat for most species has declined, but the habitats have remained diverse.

Important game birds in the survey area are sharp-tailed grouse, gray partridge, ducks, ring-necked pheasant, and geese. Extirpated species include whooping crane, sandhill crane, bald eagle, and greater prairie chicken.

Important mammals are white-tailed deer and furbearers, such as raccoon, mink, badger, striped skunk, coyote, red fox, beaver, muskrat, white-tailed jackrabbit, and fox squirrel. Extirpated species include northern swift fox, grizzly bear, bison, river otter, and elk.

In recent years Emmons County has been the residence of 1.1 percent of the state's small game hunters. It has been the location for about 4.0 percent of the statewide sharp-tailed grouse harvest, 2.0 percent of the gray partridge harvest, and 2.0 percent of the pheasant harvest. The harvest of cottontail rabbit and fox squirrel is minor. Mourning doves are not hunted in the county.

The county has about 14,000 acres of wetland type 1 (wet meadow) and 12,000 acres of wetland types 3 (shallow fresh water marsh), 4 (deep fresh water marsh), and 5 (open fresh water) (*7*). These wetlands are very important in the production of waterfowl. Also, they provide habitat for deer, furbearers, upland game, and many nongame birds and mammals.

Lake Oahe, Braddock Reservoir, Welk Reservoir, Nieuwsma Reservoir, and Rice Lake provide opportunities for fishing. The most commonly sought fish are northern pike, walleye, sauger, white bass, catfish, perch, crappie, and trout. The potential for construction of reservoirs for fish is limited.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are wheatgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include gray partridge, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, white-tailed deer, mule deer, sharptail grouse, meadowlark, and lark bunting.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills,

septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the

surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 12 gives information about the soils as a source of construction materials. The soils are rated *good, fair, poor* or *unsuited* as a source of roadfill, sand and gravel, and topsoil. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a

plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a *good* or *fair* source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 13 gives information on the soil properties and site features that affect water management. The kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system

is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering index properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 17.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The

sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided

calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16. Only saturated zones within a depth of about 6 feet are indicated.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either

soft or hard. If the rock is soft or fractured, excavations generally can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations. All of the bedrock in Emmons County is soft and can be easily excavated by small tractors and backhoes.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering test data

Table 17 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and morphology." The soil samples were tested by the Materials Laboratory of the North Dakota State Highway Department.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density—T 180A (AASHTO); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Amor series

The Amor series consists of moderately deep, well drained, moderately permeable soils on upland benches and divides. These soils formed in material weathered from stratified soft sandstone, siltstone, and loamy shale. Slope ranges from 1 to 25 percent.

Amor soils are similar to Omio and Vebar soils and are commonly adjacent to Arnegard, Cabba, Omio, and Williams soils. Arnegard and Williams soils are deep, Omio soils are fine-silty, Vebar soils are coarse-loamy, and Cabba soils are shallow.

Typical pedon of Amor loam, 9 to 15 percent slopes, 210 feet south and 1,950 feet west of the northeast corner of sec. 4, T. 132 N., R. 75 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and nonplastic; many very fine tubular pores; neutral; clear wavy boundary.

B2—6 to 19 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; common very fine roots; many very fine tubular pores; neutral; gradual wavy boundary.

Cca—19 to 29 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak fine prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; many very fine tubular pores; many medium irregularly shaped soft masses of segregated lime; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—29 to 60 inches; pale brown (10YR 6/3) soft sandstone, brown (10YR 5/3) moist.

The thickness of the solum ranges from 10 to 30 inches and the depth to soft bedrock from 20 to 40 inches. The A horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It typically is loam, but in some pedons it is silt loam. The B2 horizon has color value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is loam, sandy clay loam, or clay loam. The Cca horizon has color value of 6 or 7 (4 to 6 moist) and chroma of 2 to 4.

Arnegard series

The Arnegard series consists of deep, well drained, moderately permeable soils on residual uplands and glacial upland plains. These soils formed in loamy local alluvium. Slope ranges from 1 to 6 percent.

Arnegard soils are similar to Grassna and Parshall soils and are commonly adjacent to Omio, Temvik, and Williams soils. Omio, Temvik, and Grassna soils are fine-silty. Williams soils have an argillic horizon. Parshall soils are coarse-loamy.

Typical pedon of Arnegard loam, 3 to 6 percent slopes, 10 feet south and 750 feet west of the northeast corner of sec. 15, T. 133 N., R. 76 W.

A1—0 to 15 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate coarse subangular blocky structure parting to weak medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine tubular pores; slightly acid; gradual wavy boundary.

B2—15 to 32 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; neutral; gradual wavy boundary.

B3—32 to 42 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; neutral; gradual wavy boundary.

C—42 to 60 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; few fine prominent yellowish red (5YR 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine tubular pores; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 48 inches. The mollic epipedon is more than 16 inches thick and extends into the B2 horizon.

The A1 horizon has color value of 2 or 3 moist. It is loam or silt loam. The B horizon has hue of 10YR or 2.5Y, value of 2 to 4 moist, and chroma of 2 or 3. It is loam, clay loam, or silt loam in which the content of clay is less than 30 percent. The C horizon has color value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3.

Arveson series

The Arveson series consists of deep, poorly drained, moderately rapidly permeable soils in plane or concave areas on glacial lake plains and outwash plains. These soils formed in glacial outwash or lacustrine sediments. Slope is 0 to 1 percent.

Arveson soils are commonly adjacent to Stady, Lehr, and Parshall soils. Stady and Lehr soils are fine-loamy in the upper part and sandy or sandy-skeletal in the lower part. Parshall soils are well drained. They do not have a calcic horizon.

Typical pedon of Arveson loam, 100 feet south and 700 feet west of the northeast corner of sec. 30, T. 132 N., R. 76 W.

A11—0 to 7 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate medium granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and few fine tubular pores; slight effervescence; moderately alkaline; clear wavy boundary.

A12ca—7 to 14 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and few fine tubular pores; common fine irregularly shaped soft masses of segregated lime; strong effervescence; moderately alkaline; abrupt wavy boundary.

C1gca—14 to 26 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; violent effervescence; disseminated lime; moderately alkaline; clear wavy boundary.

C2gca—26 to 40 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; many medium prominent brownish yellow (10YR 6/8) mottles; weak fine granular structure; soft, very

friable, nonsticky and nonplastic; few very fine tubular pores; violent effervescence; disseminated lime; moderately alkaline; clear wavy boundary.

C3g—40 to 47 inches; light gray (5Y 7/1) fine sandy loam, gray (5Y 5/1) moist; common medium prominent white (10YR 8/2) and few fine prominent brownish yellow (10YR 6/8) mottles; weak fine granular structure; soft, very friable, nonsticky and nonplastic; strong effervescence; moderately alkaline; abrupt smooth boundary.

Ab—47 to 60 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; massive; very hard, friable, sticky and very plastic; slight effervescence; mildly alkaline.

The mollic epipedon ranges from 7 to 24 inches in thickness. The depth to loamy fine sand or coarser sediments is more than 20 inches.

The A horizon either has hue of 10YR, 2.5Y, or 5Y and value of 2 or 3 or is neutral in hue and has value of 2 or 3 and chroma of 0. It is mildly alkaline or moderately alkaline. The Cca horizon either has hue of 2.5Y or 5Y, value of 4 to 7, and chroma of 1 or 2 or is neutral in hue and has value of 4 to 7 and chroma of 0. It is mildly alkaline or moderately alkaline.

Banks Variant

The Banks Variant consists of deep, somewhat poorly drained, rapidly permeable soils on bottom land. These soils formed in stratified alluvium. Slope ranges from 0 to 2 percent.

Banks Variant soils are commonly adjacent to Havrelon Variant and Lallie soils. Both of these adjacent soils contain less sand and more clay than the Banks Variant soils.

Typical pedon of Banks Variant very fine sandy loam, 2,100 feet south and 350 feet west of the northeast corner of sec. 9, T. 136 N., R. 79 W.

A1—0 to 7 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; common medium faint dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; few very fine pores; slight effervescence; mildly alkaline; clear wavy boundary.

C1—7 to 20 inches; light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; few fine and very fine roots; common very fine and fine pores; slight effervescence; mildly alkaline; clear wavy boundary.

IIC2—20 to 44 inches; light brownish gray (2.5Y 6/2) loamy very fine sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; few fine pores; slight effervescence; mildly alkaline; clear wavy boundary.

IIIC3—44 to 60 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; loose, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline.

The hue is 10YR or 2.5Y, the value 5 to 7 (4 to 6 moist), and the chroma 1 to 3 throughout the profile. Typically, the hue of 2.5Y is below the A horizon.

Bearpaw series

The Bearpaw series consists of deep, well drained, slowly permeable soils on glacial till plains. These soils formed in glacial till. Slope ranges from 1 to 9 percent.

Bearpaw soils are similar to Regent soils and are commonly adjacent to Niobell, Noonan, and Williams soils. Niobell and Noonan soils have a natric horizon. Regent soils have lithic or paralithic contact 20 to 40 inches from the surface. Williams soils have a fine-loamy argillic horizon.

Typical pedon of Bearpaw silt loam, 3 to 6 percent slopes, 480 feet north and 550 feet east of the southwest corner of sec. 6, T. 130 N., R. 75 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and plastic; many very fine roots; common very fine pores; slightly acid; clear wavy boundary.

B2t—3 to 14 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to strong fine subangular blocky; hard, firm, sticky and plastic; many very fine roots; many very fine pores; few thin clay films on faces of peds and lining pores; neutral; abrupt wavy boundary.

B3ca—14 to 27 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; few medium distinct reddish brown (5YR 4/3) mottles; strong medium prismatic structure parting to strong fine subangular blocky; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; many medium irregularly shaped soft masses of segregated lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C1ca—27 to 33 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; many large faint dark grayish brown (2.5Y 4/2) and common fine distinct dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; common medium irregularly shaped soft masses of segregated lime; strong effervescence; moderately alkaline; abrupt wavy boundary.

C2—33 to 50 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common

large distinct gray (5Y 5/1) and few fine prominent brownish yellow (10YR 6/8) mottles; weak very fine subangular blocky structure; slightly hard, firm, sticky and slightly plastic; common very fine roots; many very fine tubular pores; slight effervescence; moderately alkaline; abrupt wavy boundary.

C3—50 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common medium faint dark gray (5Y 4/1) and few fine prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; slight effervescence; mildly alkaline.

The noncalcareous part of the solum ranges from 12 to 18 inches in thickness. The mollic epipedon is 8 to 12 inches thick. It has color value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. The B2t horizon ranges from 36 to 45 percent clay.

Belfield series

The Belfield series consists of deep, well drained, slowly permeable soils on uplands and terraces and in swales. These soils formed in alluvium. Slope ranges from 1 to 6 percent.

Belfield soils are similar to Niobell soils and are commonly adjacent to Grail, Regent, Daglum, and Rhoades soils. Daglum and Rhoades have strong columnar structure in the B2t horizon. Niobell soils are fine-loamy and formed in loamy glacial till. Grail and Regent soils do not have a natric horizon.

Typical pedon of Belfield silt loam, in an area of Belfield-Daglum silt loams, 3 to 6 percent slopes, 1,400 feet north and 2,300 feet west of the southeast corner of sec. 13, T. 136 N., R. 78 W.

A1—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine tubular pores; slightly acid; clear smooth boundary.

A&B—10 to 14 inches; light gray (10YR 7/1) silt loam (A2); grayish brown (10YR 5/2) silt loam (B2), very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to weak medium platy; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and few fine pores; slightly acid; abrupt smooth boundary.

B21t—14 to 19 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong fine angular blocky structure; very hard, very firm, sticky and very plastic; common very fine and few fine roots; many very fine pores; few thin clay films on faces of peds and lining pores; neutral; clear wavy boundary.

B22t—19 to 29 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and few fine pores; common thin clay films on faces of peds and lining pores; mildly alkaline; gradual wavy boundary.

B3ca—29 to 43 inches light yellowish brown (2.5Y 6/4) silty clay, olive brown (2.5Y 4/4) moist; strong medium prismatic structure parting to strong fine subangular blocky; very hard, very firm, sticky and very plastic; few very fine and fine roots; few very fine pores; common large irregularly shaped soft masses of segregated lime; slight effervescence; mildly alkaline; gradual wavy boundary.

C—43 to 60 inches; pale yellow (2.5Y 7/4) loam, olive (5Y 5/4) moist; many medium and large prominent yellowish brown (10YR 5/8) mottles; weak coarse platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; strong effervescence; moderately alkaline.

The mollic epipedon ranges from 7 to 24 inches in thickness. In some pedons it includes the upper part of the B horizon. The depth to carbonates ranges from 25 to 35 inches.

The A horizon has color value of 4 or 5 (2 or 3 moist). The B2t horizon has color value of 4 to 6 (2 to 5 moist) and chroma of 2 to 4. The C horizon is stratified local alluvium or soft siltstone, soft shale, or sandstone.

Bowbells series

The Bowbells series consists of deep, well drained, moderately slowly permeable soils in slightly concave areas on glacial till plains. These soils formed in calcareous glacial till and local alluvium. Slope ranges from 1 to 6 percent.

Bowbells soils are similar to Grassna, Flaxton, and Williams soils and are commonly adjacent to Arnegard and Williams soils. Grassna and Arnegard soils lack an argillic horizon. Flaxton soils contain more sand in the upper part of the solum than Bowbells soils. Williams soils are in convex areas. Their mollic epipedon is thinner than that of the Bowbells soils.

Typical pedon of Bowbells loam, in an area of Williams-Bowbells loams, 1 to 3 percent slopes, 2,315 feet north and 1,950 feet west of the southeast corner of sec. 23, T. 136 N., R. 75 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

A12—7 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine tubular pores; neutral; clear smooth boundary.

B21t—13 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; few thin clay films on faces of peds; neutral; clear smooth boundary.

B22t—18 to 27 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; many moderately thick clay films on faces of peds; neutral; clear smooth boundary.

C1ca—27 to 38 inches; light brownish gray (2.5Y 6/2) clay loam, light olive brown (2.5Y 5/4) moist; weak medium platy structure parting to weak medium and fine subangular blocky; very hard, firm, sticky and plastic; few fine roots; few fine tubular pores; few fine irregularly shaped soft masses of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—38 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, light olive brown (2.5Y 5/4) moist; weak medium platy structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; few fine roots; few fine tubular pores; few fine irregularly shaped soft masses of lime; strong effervescence; moderately alkaline.

The thickness of the solum, or depth to the Cca horizon, ranges from 22 to more than 36 inches. The A horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2 dry or moist. The B2 horizon ranges from loam to clay loam. The C horizon has color value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4 dry or moist.

Bowdle series

The Bowdle series consists of deep, well drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils are on outwash plains and stream terraces. They formed in loamy alluvium underlain by sand and gravel. Slope ranges from 1 to 6 percent.

Bowdle soils are similar to Stady soils and are commonly adjacent to Grassna, Lehr, Parshall, and Stady soils. Stady and Lehr soils have a mollic epipedon that is less than 16 inches thick. Grassna and Parshall soils do not have sand and gravel within a depth of 40 inches.

Typical pedon of Bowdle loam, 1 to 3 percent slopes, 2,540 feet south and 2,440 feet west of the northeast corner of sec. 11, T. 132 N., R. 78 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; neutral; abrupt smooth boundary.

B21—6 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common fine pores; neutral; clear wavy boundary.

B22—11 to 19 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; common fine pores; neutral; clear wavy boundary.

B3—19 to 23 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; common very fine pores; slight effervescence; neutral; gradual wavy boundary.

C1ca—23 to 32 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky and nonplastic; few fine roots; common very fine pores; common irregularly shaped soft masses of lime; strong effervescence; mildly alkaline; clear wavy boundary.

IIC2—32 to 60 inches; grayish brown (2.5Y 5/2) gravelly coarse sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to lime range from 14 to 32 inches. The depth to sand and gravel ranges from 20 to 40 inches. The mollic epipedon ranges from 16 to 32 inches in thickness and includes the B2 horizon.

The A horizon has color value of 3 or 4 (2 or 3 moist) and chroma of 2 dry or moist. The B2 horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 2 dry or moist. The C1ca horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4 dry or moist.

Bryant series

The Bryant series consists of deep, well drained, moderately permeable soils on loess-covered uplands. These soils formed in calcareous loess. Slope ranges from 3 to 9 percent.

Bryant soils are similar to Grassna, Omio, Temvik, and Wilton soils and are commonly adjacent to those soils. Grassna and Wilton soils have a mollic epipedon that is more than 16 inches thick. Temvik soils have glacial till within a depth of 40 inches. Omio soils are 20 to 40 inches deep over soft sandstone.

Typical pedon of Bryant silt loam, 3 to 6 percent slopes, 275 feet south and 70 feet west of the northeast corner of sec. 22, T. 130 N., R. 77 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; neutral; clear wavy boundary.

B2—8 to 14 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine tubular pores; thin organic stains along prism faces in the upper 4 inches; neutral; gradual wavy boundary.

B3—14 to 22 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, friable, nonsticky and slightly plastic; few very fine and fine roots; many very fine tubular pores; slight effervescence; mildly alkaline; clear wavy boundary.

C1ca—22 to 37 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, nonsticky and slightly plastic; few very fine roots; many very fine tubular pores; common fine and medium irregularly shaped soft masses of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—37 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; common medium distinct gray (5Y 6/1) and few medium distinct brownish yellow (10YR 6/6) mottles; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; many very fine tubular pores; few fine irregularly shaped soft masses of lime; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 15 to 35 inches. The depth to carbonates ranges from 12 to 27 inches. Loam or clay loam glacial till is 40 to 60 inches from the surface in some pedons. The mollic epipedon is 7 to 16 inches thick.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 dry or moist. The B2 horizon has color value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3 dry or moist. Some pedons have a B3ca horizon. The C horizon has hue of 2.5Y or 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4 dry or moist.

Cabba series

The Cabba series consists of shallow, well drained, moderately permeable soils on residual uplands. These soils formed in material weathered from soft siltstone and sandstone. Slope ranges from 9 to 50 percent.

Cabba soils are similar to Cohagen and Flasher soils and are commonly adjacent to Amor and Vebar soils. In Flasher and Cohagen soils, the content of clay is less than 18 percent. Vebar soils are on the mid and upper side slopes. They have a mollic epipedon. Amor soils also have a mollic epipedon. They are less sloping than Cabba soils.

Typical pedon of Cabba loam, in an area of Cabba-Amor loams, 15 to 50 percent slopes, 400 feet north and 175 feet east of the southwest corner of sec. 26, T. 133 N., R. 77 W.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; slight effervescence; mildly alkaline; clear wavy boundary.

AC—4 to 10 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many fine tubular pores; strong effervescence; mildly alkaline; gradual wavy boundary.

C—10 to 17 inches; pale yellow (2.5Y 7/3) clay loam, light olive brown (2.5Y 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr1—17 to 38 inches; light yellowish brown (2.5Y 6/3) soft siltstone, light olive brown (2.5Y 5/3) moist; platylike structure; few fine roots; strong effervescence; strongly alkaline.

Cr2—38 to 60 inches; light yellowish brown (2.5Y 6/3) soft sandstone, light olive brown (2.5Y 5/3) moist; massive; strongly alkaline.

The depth to paralithic contact is 8 to 20 inches. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 or 2. It ranges from fine sandy loam to silt loam. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 1 to 3.

Cohagen series

The Cohagen series consists of shallow, well drained, moderately rapidly permeable soils on residual uplands. These soils formed in fine sandy loam residuum of soft sandstone. Slope ranges from 9 to 50 percent.

Cohagen soils are similar to Cabba and Flasher soils and are commonly adjacent to Flasher, Parshall, and Vebar soils. Vebar and Parshall soils have a mollic epipedon. Flasher soils formed in material weathered from sandstone containing more sand than the parent material of Cohagen soils. Cabba soils have a control section of loam, silt loam, or clay loam.

Typical pedon of Cohagen fine sandy loam, in an area of Vebar-Cohagen fine sandy loams, 15 to 50 percent slopes, 1,400 feet west and 900 feet north of the southeast corner of sec. 18, T. 133 N., R. 78 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and nonplastic; many fine roots; many fine pores; slight effervescence; mildly alkaline; clear smooth boundary.

C1—3 to 9 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and slightly plastic; many fine roots; common very fine pores; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—9 to 16 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few fine pores; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—16 to 60 inches; pale yellow (2.5Y 7/4) soft sandstone, light olive brown (2.5Y 5/4) moist; massive; slightly hard, very friable; few fine roots; slight effervescence; moderately alkaline.

The depth to soft sandstone ranges from 10 to 20 inches. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3. The control section commonly is fine sandy loam or sandy loam, but the range includes loamy very fine sand.

Daglum series

The Daglum series consists of deep, moderately well drained, very slowly permeable soils on terraces and foot slopes and in upland swales. These soils formed in alluvium and in material weathered from shale. Slope ranges from 1 to 9 percent.

Daglum soils are similar to Belfield and Noonan soils and are commonly adjacent to Belfield, Regent, and Rhoades soils. In Belfield soils the A horizon interfingers into the B2t horizon. These soils lack strong columnar structure. Noonan soils contain less clay and more sand than Daglum soils. Rhoades soils have an A horizon that is less than 5 inches thick. Their solum is thinner than that of Daglum soils. Regent soils do not have a natric horizon.

Typical pedon of Daglum silt loam, in an area of Daglum-Rhoades silt loams, 1 to 3 percent slopes, 1,300 feet north and 600 feet west of the southeast corner of sec. 10, T. 133 N., R. 78 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; neutral; clear smooth boundary.

A2—4 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure parting to weak fine platy; slightly hard, very friable, nonsticky and slightly plastic; many fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

B2t—7 to 19 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium to coarse columnar structure parting to strong medium and fine angular blocky; extremely hard, very firm, sticky and plastic; common fine roots; common very fine tubular pores; common thin clay films on faces of peds and lining pores; neutral; clear wavy boundary.

B3sa—19 to 27 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to strong medium angular blocky; very hard, firm, sticky and plastic; few fine roots; few fine tubular pores; common white gypsum and salt crystals; slight effervescence; mildly alkaline; gradual wavy boundary.

C—27 to 46 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, sticky and plastic; few white crystals of salt and gypsum; strong effervescence; strongly alkaline; gradual wavy boundary.

Cr—46 to 60 inches; pale olive (5Y 6/3) shale, olive (5Y 4/3) moist.

The thickness of the solum ranges from 12 to 32 inches. The depth to soft shale is more than 40 inches.

The A1 horizon has color value of 4 or 5 (2 or 3 moist). The A2 horizon has color value of 4 to 7 (3 to 5 moist) and chroma of 1 or 2 dry or moist. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3 dry or moist. The C horizon has color value of 5 to 7 (3 to 6 moist) and chroma of 1 to 4 dry or moist.

Ekalaka series

The Ekalaka series consists of deep, well drained, slowly permeable soils on terraces, fans, and residual uplands. These soils formed in alluvium and in material weathered from soft sandstone. Slope ranges from 1 to 6 percent.

Ekalaka soils are similar to Daglum and Noonan soils and are commonly adjacent to Lihen, Parshall, and Vebar soils. Daglum soils are fine textured. Noonan soils are fine-loamy. Lihen, Parshall, and Vebar lack a natric horizon.

Typical pedon of Ekalaka fine sandy loam, 1 to 6 percent slopes, 1,400 feet east and 100 feet south of the northwest corner of sec. 3, T. 133 N., R. 78 W.

A11—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; neutral; clear smooth boundary.

A12—4 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

A2—12 to 16 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse platy structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; few very fine pores; slight effervescence; moderately alkaline; clear smooth boundary.

B2t—16 to 19 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; strong coarse columnar structure parting to weak medium angular blocky; very hard, firm, slightly sticky and slightly plastic; few fine roots; few very fine pores; few thin clay films on faces of peds and lining pores; strong effervescence; strongly alkaline; gradual wavy boundary.

B3—19 to 29 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and nonplastic; slight effervescence; strongly alkaline; gradual wavy boundary.

C—29 to 60 inches; light yellowish brown (2.5Y 6/4) sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; slight effervescence; strongly alkaline.

The thickness of the solum ranges from 16 to 40 inches and that of the mollic epipedon from 7 to 20 inches. In the natric horizon the content of clay is less than 18 percent.

The A1 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3 dry or moist. The A2 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2 dry or moist. The B2t horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6 (3 to 5 moist); and chroma of 2 to 4 dry or moist. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4 dry or moist.

Falkirk series

The Falkirk series consists of deep, well drained, moderately slowly permeable soils on glacial till plains. These soils formed in 20 to 40 inches of glaciofluvial sediments and in the underlying glacial till. Slope ranges from 1 to 6 percent.

The Falkirk soils in this county contain more sand and less clay in the IIC1 horizon than is defined as the range for the series. This difference, however, does not alter the use or behavior of the soils.

Falkirk soils are similar to Arnegard and Grassna soils and are commonly adjacent to Arnegard, Flaxton, and Williams soils. Arnegard soils are in nearby swales. They do not have glacial till within a depth of 40 inches. Grassna soils are fine-silty. Flaxton and Williams soils have an argillic horizon. Also, Williams soils have a mollic epipedon that is less than 16 inches thick.

Typical pedon of Falkirk loam, in an area of Williams-Falkirk loams, 1 to 3 percent slopes, 1,900 feet south and 400 feet west of the northeast corner of sec. 8, T. 133 N., R. 74 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure parting to moderate coarse granular; hard, friable, slightly sticky and nonplastic; few very fine pores; many fine roots; slightly acid; gradual smooth boundary.

B21—7 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and nonplastic; common fine roots; common fine pores; neutral; clear wavy boundary.

B22—17 to 22 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak fine prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and nonplastic; common fine roots; common fine pores; neutral; clear wavy boundary.

IIC1—22 to 31 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; neutral; clear wavy boundary.

IIIC2ca—31 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; few coarse distinct brown (7.5YR 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; few coarse pores; common medium irregularly shaped soft masses of lime; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 16 to 40 inches and commonly is the same as the depth to the IIC horizon. The mollic epipedon ranges from 16 to more than 30 inches in thickness and extends into the B horizon. Reaction ranges from slightly acid to moderately alkaline throughout the profile.

The A horizon has color value of 3 to 5 (2 or 3 moist). The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 or 3 dry or moist. The IIC horizon has color value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3 dry or moist. The IIIC horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4 dry or moist.

Farland series

The Farland series consists of deep, well drained, moderately slowly permeable soils on terraces and foot slopes. These soils formed in alluvium. Slope ranges from 1 to 6 percent.

Farland soils are similar to Grail and Shambo soils and are commonly adjacent to Belfield, Shambo, and Straw soils. Shambo and Straw soils do not have an argillic horizon. Belfield soils have a natric horizon. Grail soils have a mollic epipedon that is more than 16 inches thick and are fine textured.

Typical pedon of Farland silt loam, 1 to 6 percent slopes, 275 feet north and 2,500 feet west of the southeast corner of sec. 34, T. 133 N., R. 74 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; neutral; abrupt smooth boundary.

B21t—6 to 11 inches; dark grayish brown (2.5Y 4/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm, sticky and plastic; common fine roots; common fine tubular pores; few thin clay films on faces of peds; neutral; clear wavy boundary.

B22t—11 to 15 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; common fine roots; common fine tubular pores; common thin clay films on faces of peds; neutral; clear wavy boundary.

B23t—15 to 19 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; few thin clay films on faces of peds; neutral; clear wavy boundary.

B3—19 to 29 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure; very hard, very firm, sticky and plastic; few fine roots; few fine tubular pores; slight effervescence; neutral; gradual wavy boundary.

C1ca—29 to 36 inches; olive gray (5Y 5/2) silty clay loam, dark olive gray (5Y 3/2) moist; massive; very hard, very firm, sticky and plastic; few fine roots; few fine tubular pores; strong effervescence; few fine irregularly shaped soft masses of lime; mildly alkaline; gradual wavy boundary.

C2ca—36 to 54 inches; olive (5Y 5/3) silty clay loam, olive (5Y 4/3) moist; massive; very hard, very firm, sticky and plastic; few fine roots; few fine tubular pores; strong effervescence; few medium irregularly shaped soft masses of lime; moderately alkaline; diffuse irregular boundary.

C3—54 to 60 inches; pale olive (5Y 6/3) silty clay loam, olive (5Y 4/3) moist; massive; slightly hard, friable, sticky and plastic; few fine roots; few fine tubular pores; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 12 to 36 inches and the depth to lime from 8 to 30 inches. The depth to paralithic contact or to a contrasting layer in the substratum is more than 40 inches. The mollic epipedon is 8 to 16 inches thick.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3.

Flasher series

The Flasher series consists of shallow, somewhat excessively drained, rapidly permeable soils on uplands. These soils formed in material weathered from soft sandstone. Slope ranges from 6 to 35 percent.

Flasher soils are similar to Cohagen and Seroco soils and are commonly adjacent to Cohagen, Lihen, Parshall, Seroco, and Vebar soils. Cohagen soils contain less sand than Flasher soils. Lihen and Seroco soils are deep over soft sandstone. Parshall soils have a mollic epipedon. Vebar soils have a coarse-loamy control section.

Typical pedon of Flasher loamy fine sand, in an area of Flasher-Telfer loamy fine sands, 15 to 35 percent slopes, 750 feet north and 80 feet west of the southeast corner of sec. 35, T. 133 N., R. 78 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; loose, very friable, slightly sticky and nonplastic; many very fine and few fine roots; many very fine pores; neutral; clear wavy boundary.

C—5 to 14 inches; light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; common very fine pores; slight effervescence; mildly alkaline; gradual wavy boundary.

Cr1—14 to 27 inches; pale olive (5Y 6/3) soft sandstone, olive (5Y 4/3) moist; abrupt wavy boundary.

Cr2—27 to 34 inches; yellowish brown (10YR 5/6) soft sandstone, dark yellowish brown (10YR 4/6) moist; abrupt wavy boundary.

Cr3—34 to 60 inches; pale olive (5Y 6/3) soft sandstone, olive (5Y 4/3) moist.

The depth to soft sandstone ranges from 7 to 20 inches. The control section typically is loamy fine sand and fine sand.

The A1 horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3 dry or moist. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 8 (3 to 6 moist), and chroma of 2 to 4 dry or moist.

Flaxton series

The Flaxton series consists of deep, well drained soils that are moderately rapidly permeable in the upper part and moderately slowly permeable in the lower part. These soils are on glacial till plains. They formed in eolian sediments and in the underlying glacial till. Slope ranges from 1 to 15 percent.

The Flaxton soils in this county contain more sand and less clay in the B1 horizon than is defined as the range for the series. This difference, however, does not alter the use or behavior of the soils.

Flaxton soils are similar to Krem and Williams soils and are commonly adjacent to Lihen, Parshall, and Williams soils. Lihen, Krem, and Parshall soils are on nearby outwash plains. Lihen and Parshall soils do not have an argillic horizon, and Krem soils are sandy in the upper part. The mollic epipedon of Williams soils is thinner than that of Flaxton soils.

Typical pedon of Flaxton fine sandy loam, 1 to 6 percent slopes, 2,500 feet north and 1,020 feet east of the southwest corner of sec. 9, T. 130 N., R. 75 W.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to moderate medium granular; soft, very friable, slightly sticky and nonplastic; many very fine and few fine roots; many very fine pores; neutral; abrupt smooth boundary.

A12—6 to 19 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to moderate medium granular; soft, very friable, slightly sticky and nonplastic; many very fine roots; many very fine pores; neutral; gradual wavy boundary.

A13—19 to 26 inches; dark grayish brown (10YR 4/2) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and nonplastic; common very fine and few fine roots; many very fine pores; neutral; clear wavy boundary.

B1—26 to 38 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; loose, very friable, nonsticky and nonplastic; common very fine roots; many very fine pores; neutral; abrupt wavy boundary.

IIB21t—38 to 46 inches; light yellowish brown (2.5Y 6/4) clay loam, grayish brown (2.5Y 5/2) moist; strong coarse prismatic structure parting to strong medium angular blocky; very hard, very firm, sticky and plastic; common very fine roots; common very fine pores; many thin clay films on faces of peds and lining pores; slight effervescence; mildly alkaline; clear wavy boundary.

IIB22t—46 to 52 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong coarse prismatic structure parting to strong medium subangular blocky; very hard, very firm, sticky and plastic; common very fine roots; common very fine pores; few thin clay films on faces of peds and lining pores; slight effervescence; mildly alkaline; clear wavy boundary.

IIC—52 to 60 inches; pale olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; common fine prominent dark red (2.5YR 3/6) mottles; moderate very coarse subangular blocky structure parting to strong fine subangular blocky; very hard, very firm, sticky and plastic; few very fine roots; common very fine pores; few fine irregularly shaped soft masses of lime; violent effervescence; mildly alkaline.

The depth to glacial till ranges from 15 to 40 inches. In some pedons sandstone or shale is below a depth of 40 inches.

The A1 horizon has color value of 3 to 5. The IIB2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. The IIC horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4.

Grail series

The Grail series consists of deep, well drained, moderately slowly permeable soils in swales and depressions and on fans and foot slopes in the uplands. These soils formed in alluvium. Slope ranges from 1 to 3 percent.

Grail soils are similar to Arnegard and Grassna soils and are commonly adjacent to Arnegard and Regent soils. Regent soils have paralithic contact at a depth of about 40 inches. Their solum is thinner than that of Grail soils. Arnegard and Grassna soils do not have an argillic horizon.

Typical pedon of Grail silty clay loam, 1 to 3 percent slopes, 250 feet south and 1,250 feet west of the northeast corner of sec. 6, T. 132 N., R. 75 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak

coarse subangular blocky structure parting to strong fine granular; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

B21t—7 to 15 inches; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to strong medium and fine angular blocky; very hard, firm, sticky and plastic; common fine roots; few very fine pores; few thin clay films on faces of peds; neutral; gradual wavy boundary.

B22t—15 to 23 inches; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; few very fine pores; common fine roots; many thin clay films on faces of peds and lining pores; neutral; gradual wavy boundary.

B3—23 to 34 inches; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium angular blocky; hard, firm, sticky and plastic; large soft masses of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—34 to 41 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to weak medium angular blocky; hard, firm, sticky and plastic; large soft masses of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—41 to 60 inches; light yellowish brown (2.5Y 6/3) loam, olive brown (2.5Y 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline.

The solum ranges from 20 to more than 42 inches in thickness. The A horizon has color value of 2 or 3 moist. The B2t horizon averages as low as 35 percent clay in some pedons and as high as 45 percent in others. It has hue of 10YR or 2.5Y, value of 2 to 4 moist, and chroma of 2 or 3 moist.

Grassna series

The Grassna series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous loess. Slope ranges from 0 to 6 percent.

Grassna soils are similar to Arnegard and Wilton soils and are commonly adjacent to Bryant, Omio, Temvik, and Wilton soils. Arnegard soils are fine-loamy. Bryant, Omio, and Temvik soils have a mollic epipedon that is less than 16 inches thick. Wilton soils have a IIC horizon of loam or clay loam glacial till within a depth of 40 inches.

Typical pedon of Grassna silt loam, 1 to 3 percent slopes, 350 feet south and 45 feet west of the northeast corner of sec. 26, T. 129 N., R. 76 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many roots; many pores; neutral; abrupt smooth boundary.

A12—7 to 17 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common roots; many fine pores; neutral; gradual wavy boundary.

B21—17 to 30 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and slightly plastic; common fine roots; common fine pores; few clay films on faces of peds, very dark brown (10YR 2/2) moist; neutral; gradual wavy boundary.

B22—30 to 40 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and medium prismatic structure parting to moderate medium and fine angular blocky; very hard, friable, sticky and slightly plastic; few fine roots; common fine pores; neutral; clear wavy boundary.

C1ca—40 to 50 inches; pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; common fine irregularly shaped soft masses of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—50 to 60 inches; pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/4) moist; common medium distinct gray (5Y 5/1) and common fine prominent dark yellowish brown (10YR 4/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; few small accumulations of lime; strong effervescence; moderately alkaline.

Typically, the solum has no free carbonates. In most pedons it is 30 to 40 inches thick, but it ranges from 20 to 50 inches. The mollic epipedon typically is more than 30 inches thick but ranges from 16 to 40 inches.

The A horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3 dry or moist. The C horizon has color value of 6 or 7 (4 to 6 moist) and chroma of 2 to 4 dry or moist.

Hamerly series

The Hamerly series consists of deep, somewhat poorly drained, moderately slowly permeable soils on glacial till plains. These soils formed in glacial till. Slope ranges from 1 to 3 percent.

Hamerly soils are commonly adjacent to Parnell and Tonka soils. Neither of these adjacent soils has a calcic

horizon. Both are in shallow basins and the deeper depressions.

Typical pedon of Hamerly loam, 1 to 3 percent slopes, 990 feet west and 2,795 feet south of the northeast corner of sec. 5, T. 136 N., R. 74 W.

A11—0 to 5 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine pores; mildly alkaline; clear wavy boundary.

A12—5 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak moderate subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine pores; mildly alkaline; clear wavy boundary.

ACca—8 to 13 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine pores; few pebbles; few fine irregularly shaped masses of segregated lime; violent effervescence; mildly alkaline; gradual wavy boundary.

C1ca—13 to 21 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; few pebbles; disseminated lime; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—21 to 35 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; few pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—35 to 60 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; few pebbles; strong effervescence; moderately alkaline.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. The C horizon has hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 4. The Cca horizon has few or no mottles.

Harriet series

The Harriet series consists of deep, poorly drained, slowly permeable soils on terraces and bottom land. These soils formed in alluvium. Slope is 0 to 1 percent.

Harriet soils are similar to Heil soils and are commonly adjacent to Arnegard, Grail, Rhoades, and Straw soils. Heil soils do not have free lime in the solum. They formed in clayey local alluvium. Arnegard and Straw soils are well drained and are fine-loamy. They do not have a natric horizon. Grail soils are well drained. They have an argillic horizon. Rhoades soils are moderately well drained.

Typical pedon of Harriet silt loam, 40 feet north and 1,900 feet east of the southwest corner of sec. 18, T. 131 N., R. 77 W.

A2—0 to 3 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate fine platy structure parting to moderate medium granular; soft, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine pores; neutral; abrupt smooth boundary.

B21t—3 to 8 inches; grayish brown (10YR 5/2) clay loam, black (10YR 2/1) moist; strong medium and coarse prismatic structure parting to strong medium subangular blocky; hard, friable, sticky and plastic; many very fine roots; many very fine pores; common thin dark gray (10YR 4/1) clay films on faces of peds and lining pores; mildly alkaline; clear wavy boundary.

B22t—8 to 12 inches; grayish brown (10YR 5/2) clay loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; many very fine roots; many very fine pores; common thin clay films on faces of peds and lining pores; common fine white salt crystals; moderately alkaline; clear wavy boundary.

B3—12 to 18 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium angular blocky; hard, friable, sticky and plastic; common very fine roots; many very fine pores; slight effervescence; strongly alkaline; gradual wavy boundary.

C1—18 to 24 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine pores; slight effervescence; strongly alkaline; gradual wavy boundary.

C2—24 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; massive; very hard, friable, sticky and plastic; common very fine pores; strong effervescence; strongly alkaline; clear smooth boundary.

C3—40 to 60 inches; olive (5Y 5/3) silty clay loam, olive (5Y 4/3) moist; few fine prominent very dark gray (5Y 3/1) mottles; massive; very hard, friable, sticky and plastic; common very fine pores; violent effervescence; strongly alkaline.

The thickness of the solum ranges from 10 to 24 inches. Typically, visible salts are at a depth of 4 to 11 inches, but they are throughout the solum in some pedons.

The A2 horizon has hue of 10YR or 2.5Y and value of 5 or 6 (3 or 4 moist). The B2t horizon has hue of 10YR, 2.5Y, or 5Y and value of 4 or 5. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 to 3. A dark buried A horizon or strata of coarser material are below a depth of 30 inches in some pedons.

Havrelon Variant

The Havrelon Variant consists of deep, somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in alluvium. Slope is 0 to 1 percent.

Havrelon Variant soils are commonly adjacent to Banks Variant and Lallie soils. Banks Variant soils contain more sand than Havrelon Variant soils, and Lallie soils contain more clay.

Typical pedon of Havrelon Variant silt loam, 800 feet south and 500 feet east of the center of sec. 5, T. 136 N., R. 79 W.

O1—1 inch to 0; partly decomposed leaves and twigs.

A11—0 to 2 inches; light brownish gray (2.5Y 6/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; common medium distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; few fine tubular pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

A12—2 to 9 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; few fine tubular pores; slight effervescence; moderately alkaline; clear smooth boundary.

C1—9 to 21 inches; light yellowish brown (2.5Y 6/3) silt loam, olive brown (2.5Y 4/3) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; few fine tubular pores; strong effervescence; moderately alkaline; abrupt wavy boundary.

C2—21 to 44 inches; light yellowish brown (2.5Y 6/3) very fine sandy loam, olive brown (2.5Y 4/3) moist; common medium distinct dark grayish brown (2.5Y 4/2) mottles; massive; soft, friable, slightly sticky and nonplastic; many fine and few medium roots; few fine tubular pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

IIC3—44 to 60 inches; light gray (2.5Y 7/2) sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; slight effervescence; moderately alkaline.

The A horizon ranges from 5 to 10 inches in thickness. It has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 1 to 3. It is dominantly stratified silt loam and silty clay loam, but the range includes loam, clay loam, and very fine sandy loam.

Heil series

The Heil series consists of deep, poorly drained, very slowly permeable soils in closed depressions. These soils formed in alluvium. Slope is 0 to 1 percent.

Heil soils are similar to Harriet soils and are commonly adjacent to Bearpaw and Williams soils. Harriet soils formed in stratified alluvium. Bearpaw and Williams soils are well drained and are higher on the landscape than Heil soils. They do not have a natric horizon.

Typical pedon of Heil silt loam, 2,300 feet north and 450 feet east of the southwest corner of sec. 30, T. 130 N., R. 75 W.

A2—0 to 3 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to moderate very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine pores; slightly acid; abrupt smooth boundary.

B2t—3 to 28 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong coarse columnar structure parting to strong fine angular blocky; very hard, very firm, very sticky and very plastic; common very fine and few fine roots; many very fine pores; common thin clay films on faces of peds and lining pores; neutral; gradual wavy boundary.

B3—28 to 35 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak coarse prismatic structure parting to strong fine subangular blocky; very hard, very firm, very sticky and very plastic; few very fine roots; many very fine pores; slight effervescence; mildly alkaline; gradual wavy boundary.

C1g—35 to 42 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; many fine faint dark grayish brown (2.5Y 4/2) mottles; moderate very fine subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; many very fine pores; strong effervescence; moderately alkaline; clear smooth boundary.

C2g—42 to 54 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; many fine faint dark grayish brown (2.5Y 4/2) mottles; moderate very fine subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many very fine pores; strong effervescence; moderately alkaline; gradual smooth boundary.

C3g—54 to 60 inches; pale yellow (2.5Y 7/4) clay, light olive brown (2.5Y 5/4) moist; many fine distinct gray (5Y 5/1) and common fine prominent reddish brown (5YR 4/4) mottles; massive; hard, firm, sticky and plastic; few very fine roots; common very fine pores; slight effervescence; mildly alkaline.

The depth to carbonates ranges from 15 to more than 38 inches. Some pedons have a dark, platy A1 horizon, which is 1 to 3 inches thick. The A2 horizon has hue of 10YR, 2.5Y, or 5Y and value of 4 to 6 (3 to 5 moist). The B2 horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. The Cg horizon is silty clay, clay, or clay loam. Clay loam glacial till is below a depth of 40 inches in some pedons.

Krem series

The Krem series consists of deep, well drained soils that are rapidly permeable in the upper part and moderately slowly permeable in the lower part. These soils are on sand-mantled glacial uplands. They formed in eolian sand and in the underlying glacial till. Slope ranges from 1 to 9 percent.

Krem soils are similar to Flaxton soils and are commonly adjacent to Flaxton, Lihen, and Telfer soils. Flaxton soils lack the sandy upper horizons characteristic of Krem soils and are fine-loamy. Lihen and Telfer soils lack an argillic horizon.

Typical pedon of Krem loamy fine sand, 1 to 6 percent slopes, 120 feet west and 240 feet north of the southeast corner of sec. 22, T. 134 N., R. 74 W.

A11—0 to 8 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak fine granular; loose, nonsticky and nonplastic; many very fine roots; many very fine pores; neutral; abrupt wavy boundary.

A12—8 to 14 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak medium granular structure; loose, nonsticky and nonplastic; common very fine roots; many very fine pores; neutral; clear smooth boundary.

B1—14 to 27 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine pores; neutral; abrupt wavy boundary.

IIB2t—27 to 48 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; few thin clay films on faces of peds and lining pores; few pebbles; mildly alkaline; abrupt wavy boundary.

IIC1—48 to 52 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; few medium prominent brown (7.5YR 5/4) mottles; massive; soft, very friable, slightly sticky and nonplastic; few very fine roots; many very fine pores; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC2—52 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; common medium prominent olive brown (2.5Y 4/4) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; slight effervescence; few pebbles; mildly alkaline.

The depth to loamy glacial till ranges from 20 to 40 inches. The A horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3 dry or moist. The IIB2t horizon has hue of 2.5Y or 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3 dry or moist. The IIC horizon has hue of 2.5Y or 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4 dry or moist.

Lallie series

The Lallie series consists of deep, poorly drained, slowly permeable soils on bottom land. These soils formed in stratified alluvium. Slope is 0 to 1 percent.

Lallie soils are commonly adjacent to Havrelon Variant and Banks Variant soils. Havrelon Variant soils contain less clay than Lallie soils, and Banks Variant soils contain more sand.

Typical pedon of Lallie silt loam, 1,600 feet north and 680 feet east of the southwest corner of sec. 3, T. 136 N., R. 79 W.

A1—0 to 2 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium and fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine pores; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1g—2 to 8 inches; light brownish gray (2.5Y 6/2) silt loam, olive gray (5Y 4/2) moist; common medium prominent dark yellowish brown (10YR 4/6) mottles; weak medium and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; slight effervescence; mildly alkaline; gradual wavy boundary.

C2g—8 to 17 inches; olive gray (5Y 5/2) silty clay, gray (5Y 5/1) moist; common medium prominent olive brown (2.5Y 4/4) mottles; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; slight effervescence; mildly alkaline; gradual wavy boundary.

C3g—17 to 32 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 5/2) moist; common medium prominent light olive brown (2.5Y 5/4) mottles; massive; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt wavy boundary.

C4—32 to 38 inches; pale olive (5Y 6/3) silt loam, dark grayish brown (2.5Y 4/2) moist; common medium prominent light olive brown (2.5Y 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; abrupt wavy boundary.

C5—38 to 60 inches; olive (5Y 5/3) silty clay, olive gray (5Y 4/2) moist; few medium faint light olive brown

(2.5Y 5/4) mottles; massive; hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

The A horizon is 1 to 5 inches thick. It has hue of 10YR to 5Y, value of 3 to 6 (2 to 4 moist), and chroma of 1 or 2.

Lehr series

The Lehr series consists of deep, somewhat excessively drained soils that are moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. These soils are on terraces and glacial outwash plains. They formed in loamy alluvium over sand and gravel. Slope ranges from 1 to 9 percent.

Lehr soils are similar to Stady and Wabek soils and are commonly adjacent to Shambo, Stady, Telfer, and Wabek soils. Shambo and Telfer soils do not have a gravelly substratum. Stady soils are deeper to sand and gravel than Lehr soils, and Wabek soils are shallower to sand and gravel.

Typical pedon of Lehr loam, in an area of Stady-Lehr loams, 1 to 3 percent slopes, 1,500 feet north and 1,050 feet east of the southwest corner of sec. 24, T. 133 N., R. 75 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; neutral; clear smooth boundary.

B2—6 to 15 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; neutral; clear wavy boundary.

IIC1ca—15 to 19 inches; light yellowish brown (2.5Y 6/4) gravelly loamy sand, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; loose, nonsticky and nonplastic; few fine roots; many fine tubular pores; strong effervescence; mildly alkaline; clear wavy boundary.

IIC2—19 to 39 inches; light brownish gray (2.5Y 6/2) gravelly sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; few fine roots; many fine and medium tubular pores; slight effervescence; mildly alkaline; gradual smooth boundary.

IIC3—39 to 60 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; many fine and medium tubular pores; slight effervescence; mildly alkaline.

The thickness of the solum, or the depth to sand and gravel, ranges from 14 to 20 inches. The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The B2 horizon has color value of 4 to 6 (3 or 4 moist).

Lihen series

The Lihen series consists of deep, well drained, rapidly permeable soils on uplands. These soils formed in sandy alluvium and eolian deposits. Slope ranges from 1 to 9 percent.

Lihen soils are similar to Parshall and Telfer soils and are commonly adjacent to Flasher, Parshall, and Vebar soils. Parshall and Vebar soils are coarse-loamy. Flasher soils have soft sandstone within a depth of 20 inches. Telfer soils have a mollic epipedon that is less than 16 inches thick. Also, they contain no lime.

Typical pedon of Lihen loamy fine sand, 1 to 6 percent slopes, 2,565 feet south and 1,250 feet west of the northeast corner of sec. 12, T. 136 N., R. 78 W.

A11—0 to 12 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; neutral; clear smooth boundary.

A12—12 to 17 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; mildly alkaline; abrupt smooth boundary.

AC—17 to 23 inches; grayish brown (2.5Y 5/2) loamy fine sand, very dark grayish brown (2.5Y 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; irregularly shaped soft masses of lime; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—23 to 26 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine tubular pores; few fine irregularly shaped soft masses of lime; strong effervescence; mildly alkaline; abrupt smooth boundary.

C2—26 to 46 inches; grayish brown (2.5Y 5/2) loamy fine sand, olive brown (2.5Y 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine irregularly shaped soft masses of lime; strong effervescence; mildly alkaline; clear wavy boundary.

C3—46 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, olive brown (2.5Y 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; strong effervescence; mildly alkaline.

The A1 horizon has color value of 4 or 5 (2 or 3 moist). It is typically loamy fine sand, but in some pedons it is fine sandy loam. The C horizon has color value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. The 10- to 40-inch control section is loamy fine sand or loamy sand.

Manning series

The Manning series consists of deep, somewhat excessively drained soils that are moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. These soils are on alluvial terraces and glacial uplands. They formed in stratified alluvium. Slope ranges from 1 to 6 percent.

Manning soils are similar to Stady and Parshall soils and are commonly adjacent to Stady, Parshall, and Straw soils. Stady soils are fine-loamy over sandy or sandy-skeletal. Parshall soils have a mollic epipedon that is more than 16 inches thick and do not have a IIC horizon of sand and gravel. Straw soils irregularly decrease in content of organic matter with increasing depth and have a thick mollic epipedon.

Typical pedon of Manning fine sandy loam, 1 to 6 percent slopes, 500 feet south and 1,500 feet west of the northeast corner of sec. 25, T. 132 N., R. 77 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable, slightly sticky and nonplastic; many very fine and few fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

B21—7 to 16 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; soft, very friable, slightly sticky and nonplastic; common very fine roots; many very fine tubular pores; few pebbles; neutral; gradual wavy boundary.

B22—16 to 22 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and nonplastic; common very fine roots; many very fine tubular pores; few pebbles; neutral; gradual wavy boundary.

C1ca—22 to 28 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; soft, very friable, nonsticky and nonplastic; common very fine tubular pores; few fine irregularly shaped soft masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

IIC2—28 to 37 inches; light brownish gray (2.5Y 6/2) coarse sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC3—37 to 60 inches; light olive gray (5Y 6/2) coarse sand, olive gray (5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to lime range from 13 to 27 inches. The depth to sand or sand and gravel dominantly is 20 to 34 inches but ranges from 16 to 40 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 dry or moist. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4 dry or moist. The Cca horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3 dry or moist.

Neche Variant

The Neche Variant consists of deep, very poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slope is 0 to 1 percent.

Neche Variant soils are similar to Regan soils and are commonly adjacent to Regan, Harriet, and Straw soils. Regan soils have a calcic horizon. Harriet soils have a natric horizon. Straw soils have a mollic epipedon that is more than 16 inches thick. All three soils are higher on the landscape than the Neche Variant soils.

Typical pedon of Neche Variant loam, 750 feet south and 720 feet east of the northwest corner of sec. 11, T. 132 N., R. 78 W.

A1—0 to 7 inches; dark grayish brown (2.5Y 4/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and nonplastic; many very fine and few fine roots; many very fine tubular pores; slight effervescence; mildly alkaline; clear smooth boundary.

C1—7 to 19 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse subangular blocky structure parting to weak fine subangular blocky; hard, friable, slightly sticky and nonplastic; common very fine and few fine roots; many very fine tubular pores; strong effervescence; mildly alkaline; abrupt smooth boundary.

C2—19 to 23 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; common medium faint dark grayish brown (2.5Y 4/2) mottles; weak coarse subangular blocky structure parting to weak fine subangular blocky; hard, friable, slightly sticky and nonplastic; few fine and very fine roots; many very fine tubular pores; strong effervescence; mildly alkaline; clear smooth boundary.

C3—23 to 32 inches; olive (5Y 5/3) loam, dark gray (5Y 4/1) moist; many medium faint olive (5Y 4/3) mottles; weak fine subangular blocky structure; hard, friable, slightly sticky and nonplastic; many very fine tubular pores; strong effervescence; mildly alkaline; gradual smooth boundary.

C4—32 to 60 inches; olive (5Y 5/3) loam, gray (5Y 5/1) moist; many medium prominent olive brown (2.5Y

4/4) and few medium distinct yellowish brown (10YR 5/6) mottles; hard, friable, slightly sticky and nonplastic; many very fine pores; strong effervescence; mildly alkaline.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2 dry or moist. The C horizon has hue of 2.5Y, 5Y, or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 3 dry of moist. Some pedons have a buried A horizon.

Niobell series

The Niobell series consists of deep, well drained, slowly permeable soils on glacial uplands. These soils formed in glacial till. Slope ranges from 1 to 6 percent.

Niobell soils are similar to Noonan soils and are commonly adjacent to Noonan, Tonka, and Williams soils. In Noonan soils the A2 horizon does not tongue or interfinger more than 1 inch into the natric horizon. Tonka soils are poorly drained and are in closed basins and depressions. They have no natric horizon. Williams soils also have no natric horizon.

Typical pedon of Niobell loam, 1 to 6 percent slopes, 1,800 feet north and 75 feet west of the southeast corner of sec. 10, T. 129 N., R. 75 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine tubular pores; slightly acid; clear wavy boundary.

A2—6 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine platy; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine tubular pores; gray (10YR 6/1) patches of silt and sand grains on faces of peds; few pebbles; slightly acid; abrupt wavy boundary.

B2t—10 to 15 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; strong coarse columnar structure parting to strong coarse angular blocky; very hard, very firm, sticky and plastic; common very fine and few fine roots; many very fine tubular pores; few thin light brownish gray (10YR 6/2) coatings on faces of peds; few pebbles; mildly alkaline; clear wavy boundary.

B3—15 to 23 inches; light olive brown (2.5Y 5/4) loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; slight effervescence; moderately alkaline; clear wavy boundary.

C1ca—23 to 33 inches; light olive gray (5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium angular blocky structure parting to strong medium granular; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; common medium irregularly shaped soft masses of lime; strong effervescence; few pebbles; moderately alkaline; gradual wavy boundary.

C2cs—33 to 60 inches; pale olive (5Y 6/3) clay loam, dark olive gray (5Y 3/2) moist; few medium distinct brownish yellow (10YR 6/6) and yellow (10YR 7/8) mottles; weak coarse platy and subangular blocky structure parting to moderate medium granular; hard, firm, sticky and plastic; few very fine roots; common very fine and few fine tubular pores; common white crystals of salt and gypsum; strong effervescence; few pebbles; moderately alkaline.

The thickness of the solum is dominantly 19 to 27 inches but ranges from 15 to 36 inches. The A1 or Ap horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 dry or moist. The A2 horizon has hue of 2.5Y or 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2 dry or moist. It does not occur in some cultivated areas. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4 dry or moist.

Noonan series

The Noonan series consists of deep, well drained, slowly permeable soils on glacial till plains. These soils formed in glacial till. Slope ranges from 1 to 6 percent.

Noonan soils are similar to Niobell soils and are commonly adjacent to Bearpaw, Falkirk, Niobell, and Williams soils. Bearpaw, Falkirk, and Williams soils have no natric horizon. In Niobell soils albic material interfingers into the upper part of the natric horizon.

Typical pedon of Noonan loam, 1 to 6 percent slopes, 1,240 feet north and 250 feet west of the southeast corner of sec. 35, T. 130 N., R. 75 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse platy structure parting to weak fine granular; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; slightly acid; abrupt smooth boundary.

A2—6 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; few pebbles; slightly acid; abrupt smooth boundary.

B21t—9 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; strong medium prismatic structure parting to strong medium angular blocky; very hard, very firm, sticky and plastic; common very fine roots; common very fine

tubular pores; few thin clay films on faces of peds; few pebbles; mildly alkaline; clear wavy boundary.

B22t—12 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; strong medium angular blocky structure; very hard, very firm, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; few thin clay films on faces of peds; few pebbles; mildly alkaline; gradual wavy boundary.

B3ca—16 to 23 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; few fine irregularly shaped soft masses of lime; strong effervescence; few pebbles; moderately alkaline; gradual wavy boundary.

C1ca—23 to 35 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, sticky and plastic; few very fine tubular pores; few fine irregularly shaped soft masses of lime; strong effervescence; few pebbles; moderately alkaline; gradual irregular boundary.

C2—35 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, sticky and plastic; few fine irregularly shaped soft masses of lime; strong effervescence; few pebbles; moderately alkaline.

The thickness of the solum ranges from 14 to 32 inches. The A1 or Ap horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. The A2 horizon does not occur in some cultivated areas. The B2 horizon has color value of 3 to 6 (2 to 4 moist) and chroma of 2 or 3. The C horizon has color value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is loam or clay loam.

Omio series

The Omio series consists of moderately deep, well drained, moderately slowly permeable soils on residual uplands. These soils formed in loess and in material weathered from the underlying sandstone, shale, and siltstone. Slope ranges from 0 to 9 percent.

Omio soils are similar to Amor, Bryant, and Grassna soils and are commonly adjacent to those soils. Amor soils are fine-laomy. Bryant soils do not have soft bedrock within a depth of 20 to 40 inches. Grassna soils have a mollic epipedon that is more than 16 inches thick.

Typical pedon of Omio silt loam, in an area of Omio-Amor silt loams, 6 to 9 percent slopes, 1,550 feet south and 900 feet west of the northeast corner of sec. 32, T. 133 N., R. 78 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; neutral; abrupt smooth boundary.

B2—5 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate and coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; few very fine continuous pores; mildly alkaline; clear smooth boundary.

B3ca—12 to 22 inches; brown (10YR 5/3) silt loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine continuous pores; common fine irregularly shaped soft masses of lime; strong effervescence; mildly alkaline; clear smooth boundary.

C1—22 to 31 inches; light yellowish brown (2.5Y 6/4) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine continuous pores; strong effervescence; mildly alkaline; abrupt wavy boundary.

IIC2—31 to 38 inches; olive (5Y 5/3) silt loam, olive (5Y 4/3) moist; strong medium and coarse angular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine roots following interfaces between adjacent peds; few very fine discontinuous pores; strong effervescence; mildly alkaline; abrupt wavy boundary.

IICr—38 to 60 inches; light olive gray (5Y 6/2) stratified soft siltstone.

The thickness of the solum ranges from 13 to 26 inches. The depth to carbonates ranges from 12 to 26 inches. The depth to soft bedrock ranges from 20 to 40 inches.

The A horizon has color value of 3 or 4 (2 or 3 moist). The B2 horizon has color value of 3 to 5 (3 or 4 moist) and chroma of 2 to 4. The C horizon has hue of 10YR, 2.5Y, or 5Y and value of 5 to 7 (4 or 5 moist).

Parnell series

The Parnell series consists of deep, very poorly drained, slowly permeable soils in closed depressions in glacial and residual uplands. These soils formed in water-sorted sediments and glacial till. Slope is 0 to 1 percent.

Parnell soils are similar to Tonka soils and are commonly adjacent to Hamerly and Williams soils. Hamerly soils have a calcic horizon. Tonka soils have an albic horizon that is more than 4 inches thick. They are poorly drained. Williams soils are higher on the landscape than Parnell soils and are more sloping.

Typical pedon of Parnell silt loam, 350 feet south and 500 feet east of the northwest corner of sec. 36, T 131 N., R. 75 W.

A11—0 to 6 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; moderate very fine subangular blocky structure parting to moderate very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; slightly acid; abrupt smooth boundary.

A12—6 to 9 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium platy structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; common very fine and few fine roots; common very fine and few fine tubular pores; neutral; clear smooth boundary.

B21tg—9 to 18 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; common thin clay films on faces of peds and lining pores; mildly alkaline; gradual wavy boundary.

B22tg—18 to 39 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; many thin clay films on faces of peds and lining pores; mildly alkaline; gradual wavy boundary.

B31g—39 to 48 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; few very fine tubular pores; mildly alkaline; gradual wavy boundary.

B32g—48 to 60 inches; gray (5Y 5/1) clay loam, very dark gray (5Y 3/1) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few very fine tubular pores; neutral.

The A1 horizon has hue of 10YR, 2.5Y, or 5Y; value of 2 or 3 moist; and chroma of 1 or less. It is silt loam or silty clay loam. Some pedons have an A2 horizon, which is less than 4 inches thick. The B horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5 (2 to 4 moist); and chroma of 1 or 2. It is silty clay, silty clay loam, clay loam, or clay. Reaction ranges from slightly acid to moderately alkaline throughout the profile.

Parshall series

The Parshall series consists of deep, well drained, moderately rapidly permeable soils on outwash plains. These soils formed in alluvium. Slope ranges from 1 to 9 percent.

Parshall soils are commonly adjacent to Flasher and Lihen soils. Flasher soils lack a mollic epipedon. Lihen soils are sandy.

Typical pedon of Parshall fine sandy loam, in an area of Parshall-Lihen fine sandy loams, 1 to 6 percent slopes, 500 feet north and 2,265 feet west of the southeast corner of sec. 19, T. 136 N., R. 77 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots; common very fine pores; neutral; abrupt smooth boundary.

A12—6 to 21 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots; common very fine pores; neutral; clear wavy boundary.

B2—21 to 30 inches; yellowish brown (10YR 5/4) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable, nonsticky and slightly plastic; few very fine roots; few very fine pores; neutral; clear wavy boundary.

C1—30 to 38 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine pores; neutral; clear wavy boundary.

C2—38 to 46 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine pores; neutral; clear wavy boundary.

C3ca—46 to 60 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 24 to 60 inches. The A1 or Ap horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 2. The B2 horizon has color value of 4 or 5 (2 or 3 moist) and chroma of 2 to 4. The C horizon is fine sandy loam, sandy loam, loam, or loamy sand.

Reeder series

The Reeder series consists of moderately deep, well drained, moderately permeable soils on residual uplands. These soils formed in material weathered from soft sandstone, siltstone, and shale. Slope ranges from 1 to 15 percent.

Reeder soils are similar to Williams soils and are commonly adjacent to Amor, Omio, and Williams soils. Amor and Omio soils lack an argillic horizon. Williams soils formed in glacial till.

Typical pedon of Reeder loam, 3 to 6 percent slopes, 500 feet north and 1,300 feet west of the southeast corner of sec. 15, T. 132 N., R. 75 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; slightly acid; abrupt smooth boundary.

B21t—6 to 13 inches; brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to strong fine subangular blocky; slightly hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; common thin very dark grayish brown (10YR 3/2) clay films on faces of peds and lining pores; neutral; gradual wavy boundary.

B22t—13 to 20 inches; light yellowish brown (10YR 6/4) sandy clay loam, brown (10YR 5/3) moist; strong medium prismatic structure parting to strong fine subangular blocky; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; common thin dark yellowish brown (10YR 4/4) clay films on faces of peds and lining pores; neutral; clear wavy boundary.

Cca—20 to 25 inches; pale olive (5Y 6/3) sandy clay loam, olive (5Y 5/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; common medium soft masses of lime; strong effervescence; mildly alkaline; clear wavy boundary.

Cr1—25 to 32 inches; pale yellow (5Y 7/3) soft sandstone, olive (5Y 5/3) moist; gradual wavy boundary.

Cr2—32 to 60 inches; pale yellow (5Y 7/3) soft sandstone, grayish brown (2.5Y 5/2) moist.

The depth to free lime ranges from 0 to 26 inches. The depth to soft sandstone or siltstone is 20 to 40 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It is silt loam, loam, or extremely stony loam. The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is loam or sandy clay loam. The soft sandstone or siltstone has hue of 10YR, 2.5Y, or 5Y and value of 4 to 7.

Regan series

The Regan series consists of deep, poorly drained, moderately slowly permeable soils in swales and depressions in glacial melt water channels. These soils formed in alluvium. Slope is 0 to 1 percent.

Regan soils are commonly adjacent to Parnell and Straw soils, both of which lack a calcic horizon.

Typical pedon of Regan silt loam, 400 feet north and 1,850 feet east of the southwest corner of sec. 4, T. 134 N., R. 74 W.

A1—0 to 12 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to moderate medium granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine pores; strong effervescence; mildly alkaline; clear smooth boundary.

C1ca—12 to 26 inches; gray (N 6/0) silt loam, dark gray (N 4/0) moist; weak medium angular blocky structure parting to weak medium granular; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; many very fine pores; strong effervescence; disseminated lime; mildly alkaline; clear wavy boundary.

C2ca—26 to 35 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak medium granular; hard, friable, slightly sticky and slightly plastic; many very fine tubular pores; strong effervescence; disseminated lime; mildly alkaline; gradual wavy boundary.

IIC3—35 to 60 inches; light gray (2.5Y 7/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse platy structure; hard, very friable, slightly sticky and slightly plastic; common very fine tubular pores; mildly alkaline.

The mollic epipedon ranges from 7 to 16 inches in thickness. Crystals of gypsum and soluble salts are in some pedons.

The A1 horizon is neutral in hue or has hue of 10YR, 2.5Y, or 5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1 or less. The Cca horizon is neutral in hue or has hue of 2.5Y or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2 dry or moist. The IIC horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3.

Regent series

The Regent series consists of moderately deep, well drained, slowly permeable soils on residual uplands. These soils formed in material weathered from soft siltstone and shale. Slope ranges from 1 to 15 percent.

Regent soils are similar to Grail soils and are commonly adjacent to Daglum, Grail, and Rhoades soils. Daglum and Rhoades soils have a natric horizon. They are lower on the landscape than Regent soils. Grail soils have a mollic epipedon that is more than 16 inches thick. They are in swales.

Typical pedon of Regent silty clay loam, 6 to 9 percent slopes, 1,800 feet south and 1,800 feet east of the northwest corner of sec. 25, T. 134 N., R. 75 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium and coarse prismatic structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine pores; neutral; clear wavy boundary.

B21t—6 to 13 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium and coarse prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; common very fine roots; many very fine pores; few thin clay films on faces of peds and lining pores; mildly alkaline; gradual wavy boundary.

B22t—13 to 21 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium and coarse prismatic structure parting to strong medium angular blocky; very hard, firm, sticky and plastic; common very fine roots; few very fine pores; common thin clay films on faces of peds and lining pores; slight effervescence; mildly alkaline; gradual wavy boundary.

B3ca—21 to 31 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to strong medium and coarse subangular blocky; very hard, firm, sticky and plastic; few very fine roots; common very fine pores; common fine irregularly shaped soft masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—31 to 60 inches; light gray (2.5Y 7/2) soft shale, grayish brown (2.5Y 5/2) moist.

The depth to soft shale is dominantly 30 to 40 inches but ranges from 20 to 40 inches. Reaction ranges from neutral to moderately alkaline throughout the profile. The mollic epipedon ranges from 7 to 16 inches in thickness.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3 dry or moist. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3 dry or moist.

Rhoades series

The Rhoades series consists of deep, moderately well drained, very slowly permeable soils on uplands, fans, and terraces. These soils formed in stratified loamy and clayey material weathered from soft shale. Slope ranges from 1 to 9 percent.

Rhoades soils are similar to Belfield and Daglum soils and are commonly adjacent to Belfield, Daglum, and Reeder soils. Belfield soils have a mollic epipedon that is thicker than that of Rhoades soils. Also, their B horizon is blocky or prismatic. Daglum soils do not have visible salts within a depth of 16 inches. Reeder soils lack a natric horizon and are fine-loamy.

Typical pedon of Rhoades silt loam, 1 to 9 percent slopes, 1,700 feet south and 600 feet west of the northeast corner of sec. 4, T. 133 N., R. 78 W.

A2—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine prismatic structure parting to moderate fine platy; soft, very friable, slightly sticky and slightly plastic; many fine roots; slightly acid; clear smooth boundary.

B21t—4 to 10 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium and coarse columnar structure parting to strong very fine angular blocky; extremely hard, very firm, sticky and plastic; few fine roots; few very fine pores; many thin clay films on faces of peds and lining pores; mildly alkaline; clear smooth boundary.

B22t—10 to 14 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to strong fine angular blocky; extremely hard, very firm, sticky and plastic; few fine roots; few very fine pores; many thin clay films on faces of peds and lining pores; slight effervescence; moderately alkaline; clear wavy boundary.

B3cs—14 to 24 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium angular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine gypsum crystals; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—24 to 38 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; hard, firm, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—38 to 48 inches; pale olive (5Y 6/3) silty clay, olive (5Y 5/3) moist; massive; slightly hard, firm, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—48 to 60 inches; pale olive (5Y 6/3) soft shale, olive (5Y 5/3) moist.

The depth to soft shale is more than 40 inches. Reaction ranges from medium acid to strongly alkaline throughout the profile.

Some pedons have a thin A1 horizon. The A horizon is 1 to 5 inches thick. The A2 horizon has hue of 10YR, value of 4 to 6 (2 to 5 moist), and chroma of 2 dry or moist. The B2t horizon has color value of 4 or 5 (2 or 3 moist).

Seroco series

The Seroco series consists of deep, excessively drained, rapidly permeable soils on uplands. These soils formed in wind-deposited sand. Slope ranges from 1 to 35 percent.

Seroco soils are similar to Lihen and Telfer soils and are commonly adjacent to Flasher, Lihen, Parshall, and Telfer soils. Lihen, Telfer, and Parshall soils have a mollic epipedon. Flasher soils are on uplands. They are 7 to 20 inches deep over soft sandstone.

Typical pedon of Seroco fine sand, 1 to 9 percent slopes, 1,100 feet west and 500 feet north of the southeast corner of sec. 1, T. 132 N., R. 78 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; loose, very friable, nonsticky and nonplastic; common very fine and few fine roots; common very fine pores; neutral; clear smooth boundary.

Cr—4 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; few very fine pores; neutral.

Reaction ranges from slightly acid to mildly alkaline throughout the profile. The 10- to 40-inch control section is loamy fine sand, loamy sand, or fine sand.

The A horizon has hue of 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3 dry or moist. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4 dry or moist.

Shambo series

The Shambo series consists of deep, well drained, moderately permeable soils on alluvial terraces and fans. These soils formed in calcareous alluvium. Slope ranges from 1 to 6 percent.

Shambo soils are similar to Omio and Amor soils and are commonly adjacent to Arnegard, Parshall, and Williams soils. Amor soils have soft bedrock within a depth of 20 to 40 inches. Arnegard soils have a mollic epipedon that is more than 16 inches thick. Omio soils are fine-silty. Parshall soils are coarse-loamy. Williams soils have an argillic horizon and formed in glacial till.

Typical pedon of Shambo loam, 3 to 6 percent slopes, 330 feet north and 2,020 feet east of the southwest corner of sec. 18, T. 130 N., R. 75 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; neutral; clear smooth boundary.

B2—5 to 14 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; neutral; clear smooth boundary.

B3ca—14 to 20 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; common medium soft masses of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—20 to 31 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; common medium soft masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—31 to 60 inches; pale olive (5Y 6/3) loam, olive (5Y 5/3) moist; weak moderate subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine pores; slight effervescence; strongly alkaline.

The thickness of the solum is dominantly 14 to 20 inches but ranges from 14 to 32 inches. The mollic epipedon is 7 to 16 inches thick.

The A1 horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3 dry or moist. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4 dry or moist. The C horizon has color value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4 dry or moist.

Stady series

The Stady series consists of deep, well drained soils that are moderately permeable in the upper part and very rapidly permeable in the lower part. These soils are on glacial outwash plains and terraces. They formed in loamy alluvium that is moderately deep over sand and gravel. Slope ranges from 1 to 9 percent.

Stady soils are similar to Lehr, Manning, and Shambo soils and are commonly adjacent to Lehr, Manning, Shambo, and Wabek soils. Lehr soils are less than 20 inches deep over sand and gravel. Manning soils are coarse-loamy over sandy or sandy-skeletal. Shambo soils do not have a gravelly IIC horizon within a depth of 40 inches. Wabek soils have no B horizon and have a solum that is less than 10 inches thick.

Typical pedon of Stady loam, in an area of Stady-Lehr loams, 3 to 6 percent slopes, 50 feet north and 1,120 feet west of the southeast corner of sec. 23, T. 130 N., R. 76 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate coarse subangular blocky structure parting to moderate fine granular; hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine pores; neutral; clear wavy boundary.

B2—7 to 15 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; neutral; clear wavy boundary.

B3ca—15 to 22 inches; light gray (2.5Y 7/2) loam, dark grayish brown (10YR 4/2) moist; moderate coarse

prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; common medium irregularly shaped soft masses of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—22 to 26 inches; light gray (2.5Y 7/2) gravelly loam, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; common medium irregularly shaped soft masses of lime; strong effervescence; moderately alkaline; abrupt wavy boundary.

IIC2—26 to 41 inches; light brownish gray (2.5Y 6/2) gravelly very coarse sand, dark grayish brown (2.5Y 4/2) moist; massive; soft, nonsticky and nonplastic; many fine and common medium pores; slight effervescence; moderately alkaline; gradual smooth boundary.

IIC3—41 to 60 inches; light brownish gray (2.5Y 6/2) gravelly very coarse sand, dark grayish brown (2.5Y 4/2) moist; massive; soft, nonsticky and nonplastic; many medium and few coarse pores; slight effervescence; moderately alkaline.

The depth to sand and gravel ranges from 20 to 40 inches and the depth to carbonates from 15 to 25 inches. The A horizon has color value of 3 to 5 (2 or 3 moist). The B horizon has color value of 4 to 7 (2 to 4 moist). The B3 and Cca horizons have hue of 10YR or 2.5Y.

Straw series

The Straw series consists of deep, well drained, moderately permeable soils on alluvial fans, terraces, and flood plains. These soils formed in calcareous alluvium. Slope ranges from 1 to 3 percent.

The Straw soils in Emmons County contain more silt and less sand and are leached of carbonates to a greater depth than is defined as the range for the Straw series. These differences, however, do not alter the use or behavior of the soils.

Straw soils are similar to Arnegard soils, which lack free carbonates throughout.

Typical pedon of Straw silt loam, 1 to 3 percent slopes, 1,100 feet north and 1,000 feet west of the southeast corner of sec. 10, T. 132 N., R. 77 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine pores; neutral; clear smooth boundary.

A12—8 to 24 inches; dark grayish brown (2.5Y 4/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; neutral; abrupt smooth boundary.

C1ca—24 to 37 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse platy structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine pores; few fine irregularly shaped soft masses of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C2ca—37 to 44 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; many medium irregularly shaped soft masses of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C3—44 to 60 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse platy structure; slightly hard, friable, nonsticky and nonplastic; many very fine pores; strong effervescence; moderately alkaline.

The mollic epipedon ranges from 16 to 40 inches in thickness. The A horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). The C horizon has hue of 2.5Y or 10YR. It has lenses of sandy loam in some pedons.

Sutley series

The Sutley series consists of deep, well drained, moderately permeable soils on loess-mantled uplands. These soils formed in calcareous loess. Slope ranges from 3 to 35 percent.

Sutley soils are similar to Bryant soils and are commonly adjacent to Bryant and Farland soils, both of which are fine-silty.

Typical pedon of Sutley silt loam, 3 to 9 percent slopes, 2,440 feet north and 100 feet east of the southwest corner of sec. 30, T. 130 N., R. 77 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky and nonplastic; many very fine roots; common very fine pores; mildly alkaline; clear smooth boundary.

C1—5 to 13 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and nonplastic; common very fine roots; common very fine pores; few soft masses of lime; slight effervescence; moderately alkaline; gradual wavy boundary.

C2ca—13 to 34 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; few very fine roots; common very fine pores; many soft masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C3ca—34 to 60 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine pores; many soft masses of lime; violent effervescence; moderately alkaline.

The depth to carbonates is less than 10 inches. The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma or 2 or 3 dry or moist. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4 dry or moist. It is silt loam or very fine sandy loam. It is mildly alkaline or moderately alkaline.

Telfer series

The Telfer series consists of deep, somewhat excessively drained, rapidly permeable soils on terraces and uplands. These soils formed in wind- and water-deposited sand. Slope ranges from 1 to 20 percent.

Telfer soils are similar to Flasher, Lihen, and Seroco soils and are commonly adjacent to Flasher, Lihen, Seroco, and Parshall soils. Flasher and Seroco soils lack a mollic epipedon. Flasher soils are on uplands, and Seroco soils are on ridges. Lihen soils have an A horizon that is thicker than that of Telfer soils. They are in swales and on foot slopes. Parshall soils have a mollic epipedon that is more than 16 inches thick and are coarse-loamy.

Typical pedon of Telfer loamy fine sand, 1 to 6 percent slopes, 2,350 feet north and 2,120 feet west of the southeast corner of sec. 7, T. 136 N., R. 78 W.

A1—0 to 11 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; loose, very friable, nonsticky and nonplastic; neutral; gradual smooth boundary.

AC—11 to 15 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; neutral; clear smooth boundary.

C1—15 to 34 inches; light olive brown (2.5Y 5/3) loamy sand, olive brown (2.5Y 4/3) moist; single grain; loose, nonsticky and nonplastic; neutral; abrupt smooth boundary.

C2—34 to 60 inches; light olive brown (2.5Y 5/3) fine sand, olive brown (2.5Y 4/3) moist; single grain; loose, nonsticky and nonplastic; slight effervescence; mildly alkaline.

Some pedons have no free carbonates to a depth of 60 inches. The mollic epipedon is 10 to 16 inches thick.

The A1 horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3 dry or moist. The AC horizon has value of 4 or 5 dry and chroma of 2 or 3 dry or moist. The C horizon has hue of 10YR or 2.5Y, value of 4 to 7 (4 or 5 moist), and chroma of 2 to 4 dry or moist.

Temvik series

The Temvik series consists of deep, well drained, moderately slowly permeable soils on loess-mantled till plains. These soils formed in loess over glacial till. Slope ranges from 3 to 9 percent.

Temvik soils are similar to the Bryant, Omio, and Wilton soils and are commonly adjacent to Bryant, Grassna, Omio, Williams, and Wilton soils. Bryant soils have glacial till at a depth of 40 inches or more. Grassna soils have a mollic epipedon that typically is more than 30 inches thick. Omio soils have soft siltstone or sandstone within a depth of 40 inches. Williams soils are fine-loamy and have an argillic horizon. Wilton soils are pachic.

Typical pedon of Temvik silt loam, 3 to 6 percent slopes, 280 feet east and 2,605 feet north of the southwest corner of sec. 20, T. 135 N., R. 76 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky and weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; many very fine pores; neutral; abrupt smooth boundary.

B21—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium prismatic and weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many roots; many pores; thin clay films on vertical faces of peds and common thin clay films on horizontal faces of peds; few thin tongues of the Ap horizon; neutral; gradual wavy boundary.

B22—11 to 20 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate coarse and medium prismatic structure parting easily to moderate coarse and medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common roots; common fine pores; thin clay films on faces of peds; neutral; clear wavy boundary.

B3—20 to 24 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; few roots; common fine pores; few pebbles and stones at the base of the horizon; neutral; clear wavy boundary.

IIC1ca—24 to 36 inches; light brownish gray (2.5Y 6/2) clay loam, olive brown (2.5Y 4/4) moist; common

fine distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, friable, sticky and plastic; about 3 percent gravel; many medium and few large soft masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC2ca—36 to 44 inches; light olive gray (5Y 6/2) clay loam, olive brown (2.5Y 4/4) moist; few fine prominent strong brown (7.5YR 5/6) mottles; weak coarse and fine subangular blocky structure; hard, friable, sticky and plastic; about 3 percent gravel; common masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC3—44 to 60 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; about 3 percent gravel; few small soft masses of lime; strong effervescence; moderately alkaline.

The solum typically is about 24 inches thick but ranges from 16 to 30 inches. Depth to the underlying glacial till is 20 to 40 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. The IIC horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. Soft sandstone, siltstone, or shale is below a depth of 40 inches in some pedons.

Tonka series

The Tonka series consists of deep, poorly drained, slowly permeable soils in closed basins and depressions. These soils formed in local alluvium and in the underlying glacial till. Slope is less than 1 percent.

Tonka soils are similar to Parnell soils and are commonly adjacent to Parnell and Williams soils. Parnell soils are in depressions that are larger and deeper than those occupied by Tonka soils, and they are wet for longer periods. They do not have the thick albic horizon characteristic of Tonka soils. Williams soils do not have an albic horizon. They are well drained.

Typical pedon of Tonka silt loam, 2,500 feet south and 1,200 feet east of the northwest corner of sec. 5, T. 133 N., R. 74 W.

A1—0 to 6 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral; abrupt wavy boundary.

A2—6 to 18 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; many medium prominent dark brown (7.5YR 4/4) mottles; moderate fine and medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; medium acid; clear wavy boundary.

B21t—18 to 26 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; common medium prominent dark brown (7.5YR 4/4) mottles; moderate medium and coarse prismatic structure parting to moderate fine subangular blocky; extremely hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; many thick clay films on faces of peds; medium acid; gradual wavy boundary.

B22t—26 to 39 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; few fine prominent dark brown (7.5YR 4/4) mottles; weak medium and coarse prismatic structure parting to moderate fine subangular blocky; extremely hard, firm, sticky and plastic; common thin clay films on faces of peds; medium acid; gradual wavy boundary.

C—39 to 60 inches; olive gray (5Y 5/2) silty clay loam, dark olive gray (5Y 3/2) moist; massive; extremely hard, firm, sticky and plastic; medium acid.

The depth to carbonates commonly is 28 to 40 inches but ranges from 20 to more than 60 inches. The A1 horizon has color value of 3 or 4 (2 or 3 moist) and chroma of 1 or less. The A2 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 0 to 2 dry or moist. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. The C horizon is loamy glacial till or local alluvium.

Vebar series

The Vebar series consists of moderately deep, well drained, moderately rapidly permeable soils on residual uplands. These soils formed in material weathered from soft sandstone and shale. Slope ranges from 1 to 50 percent.

Vebar soils are similar to Amor soils and are commonly adjacent to Arnegard, Flasher, and Omio soils. Amor and Arnegard soils are fine-loamy, and Omio soils are fine-silty. Flasher soils lack a mollic epipedon and have paralithic contact within a depth of 20 inches.

Typical pedon of Vebar fine sandy loam, 9 to 15 percent slopes, 620 feet north and 510 feet east of the southwest corner of sec. 11, T. 134 N., R. 77 W.

A1—0 to 7 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium granular structure; soft, very friable, slightly sticky and nonplastic; many very fine roots; neutral; abrupt smooth boundary.

B21—7 to 13 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly

sticky and nonplastic; common very fine and few fine roots; few very fine tubular pores; neutral; gradual smooth boundary.

B22—13 to 23 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; common very fine roots; few fine tubular pores; neutral; clear wavy boundary.

C—23 to 30 inches; light yellowish brown (2.5Y 6/4) loamy fine sand, olive brown (2.5Y 4/4) moist; moderate coarse prismatic structure; soft, very friable, slightly sticky and nonplastic; few very fine roots; few very fine tubular pores; neutral; clear wavy boundary.

Cr1—30 to 47 inches; light yellowish brown (2.5Y 6/4) soft sandstone, olive brown (2.5Y 4/4) moist; clear smooth boundary.

Cr2—47 to 60 inches; pale olive (5Y 6/3) soft sandstone, light olive brown (2.5Y 5/4) moist.

The thickness of the solum typically is about 23 inches but ranges from 15 to 40 inches. The depth to soft sandstone ranges from 20 to 40 inches. The mollic epipedon is 7 to 16 inches thick.

The A1 horizon has color value of 3 or 4 (2 or 3 moist) and chroma of 2 or 3 dry or moist. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4 dry or moist. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4 dry or moist.

Wabek series

The Wabek series consists of deep, excessively drained, very rapidly permeable soils on outwash plains and stream terraces. These soils formed in loamy sediments that are shallow or very shallow over sand and gravel. Slope ranges from 6 to 15 percent.

Wabek soils are similar to Lehr soils and are commonly adjacent to Lehr, Manning, and Stady soils on terraces or outwash plains. The solum of these adjacent soils is thicker than that of Wabek soils.

Typical pedon of Wabek loam, 6 to 15 percent slopes, 1,250 feet south and 2,620 feet west of the northeast corner of sec. 13, T. 132 N., R. 77 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; few very fine tubular pores; mildly alkaline; abrupt wavy boundary.

IIC1ca—6 to 9 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; few very fine pores; lime crusts coat underside of gravel; about 25 percent gravel; strong effervescence; mildly alkaline; clear irregular boundary.

IIIC2—9 to 60 inches; pale brown (10YR 6/3) very gravelly coarse sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; common very fine roots; about 45 percent gravel; slight effervescence; mildly alkaline.

The depth to sand and gravel ranges from 7 to 14 inches. The depth to carbonates typically ranges from 4 to 9 inches, but some pedons have no free carbonates. The mollic epipedon is 7 or 8 inches thick. In the control section, the content of gravel, by volume, is more than 35 percent. The A1 horizon has color value of 4 or 5 (2 or 3 moist).

Williams series

The Williams series consists of deep, well drained, moderately slowly permeable soils on glacial till plains. These soils formed in calcareous glacial till. Slope ranges from 1 to 20 percent.

Williams soils are commonly adjacent to Niobell, Noonan, Tonka, and Zahl soils. Niobell and Noonan have a natric horizon. Tonka soils are poorly drained. Zahl soils have a solum that is thinner than that of Williams soils. Also, they lack an argillic horizon.

Typical pedon of Williams loam, in an area of Williams-Bowbells loams, 3 to 6 percent slopes, 70 feet south and 105 feet west of the northeast corner of sec. 23, T. 130 N., R. 76 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; common fine and many very fine roots; many very fine tubular pores; neutral; clear wavy boundary.

B2t—5 to 14 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to coarse fine subangular blocky; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; many moderately thick clay films on faces of peds; few pebbles; mildly alkaline; clear irregular boundary.

C1ca—14 to 32 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; strong effervescence; common medium irregularly shaped masses of segregated lime; few pebbles; moderately alkaline; gradual wavy boundary.

C2—32 to 45 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; many

medium distinct very dark gray (5Y 3/1) and few fine prominent olive (5Y 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; few very fine tubular pores; slight effervescence; numerous soft masses of gypsum crystals; few pebbles; moderately alkaline; diffuse wavy boundary.

C3—45 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine tubular pores; slight effervescence; few pebbles; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 10 to 30 inches. The A horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 2. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. The C horizon has hue of 2.5Y or 5Y, value of 5 to 8 (3 to 6 moist), and chroma of 2 to 4.

Wilton series

The Wilton series consists of deep, well drained, moderately slowly permeable soils on glacial uplands. These soils formed in loess and in the underlying glacial till. Slope ranges from 1 to 3 percent.

Wilton soils are similar to Grassna, Temvik, and Williams soils. They commonly are adjacent to those soils. Grassna soils are in swales and drainageways where silty deposits are more than 40 inches thick. Temvik soils have a mollic epipedon that is less than 16 inches thick. Williams soils are fine-loamy, have an argillic horizon, and have a mollic epipedon that is less than 16 inches thick.

Typical pedon of Wilton silt loam, 1 to 3 percent slopes, 2,535 feet west and 280 feet south of the northeast corner of sec. 29, T. 135 N., R. 76 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium granular structure; soft, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; slightly acid; abrupt smooth boundary.

B21—8 to 23 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine tubular pores; neutral; clear wavy boundary.

IIB22—23 to 34 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak moderate subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; mildly alkaline; clear wavy boundary.

IIC1ca—34 to 49 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; few very fine and fine roots; many very fine tubular pores; many medium irregularly shaped soft masses of lime; violent effervescence; few pebbles; moderately alkaline; clear wavy boundary.

IIC2ca—49 to 60 inches; pale olive (5Y 6/3) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; few fine and very fine roots; many very fine tubular pores; many medium irregularly shaped soft masses of lime; violent effervescence; few pebbles; moderately alkaline.

The solum typically is about 34 inches thick but ranges from 20 to 36 inches. Depth to the finer textured IIC horizon is 20 to 40 inches. The mollic epipedon ranges from 16 to 30 inches in thickness and commonly includes most of the B horizon.

The A horizon has color value of 3 to 5 (2 or 3 moist) and chroma of 2 dry or moist. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 to 4 dry or moist. The IICca horizon has color value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4.

Zahl series

The Zahl series consists of deep, well drained, moderately slowly permeable soils on glacial uplands. These soils formed in calcareous glacial till. Slope ranges from 6 to 25 percent.

Zahl soils are commonly adjacent to Arnegard, Parnell, and Williams soils. Arnegard soils are pachic. They are in smooth and concave areas. Parnell soils are in low basins and are very poorly drained. Williams soils have an argillic horizon.

Typical pedon of Zahl loam, in an area of Williams-Zahl loams, 9 to 25 percent slopes, 3,000 feet south and 1,750 feet west of the northeast corner of sec. 8, T. 134 N., R. 77 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; neutral; abrupt wavy boundary.

C1ca—6 to 22 inches; grayish brown (2.5Y 5/2) loam, olive brown (2.5Y 4/4) moist; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; violent effervescence; few fine irregularly shaped soft masses of lime; moderately alkaline; gradual wavy boundary.

C2—22 to 60 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) moist; weak coarse subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; strong effervescence; moderately alkaline.

The A horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Calciaquolls (*Calc*, meaning a calcic horizon, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Calciaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, frigid, Typic Calciaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Formation of the soils

This section describes the major factors of soil formation affecting the soils in Emmons County.

Soil forms through the physical and chemical weathering of deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief; and (5) the length of time that the processes of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through weathering and slowly change it into a soil that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Generally, a long period is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent material

Emmons County is near the western edge of the glaciated part of North Dakota. The mantle of glacial deposits ranges from thin and patchy in the western part of the county to thick and continuous in the northern and eastern parts. Bearpaw, Niobell, Noonan, Parnell, Tonka, Williams, and Zahl soils formed in glacial till.

Some soils formed in glacial melt water deposits. Examples are Lehr, Stady, and Wabek soils. In some

areas the glacial melt water deposits have been resorted and redistributed by wind. In these areas the landscape is undulating or dunelike. Flaxton, Krem, Lihen, and Telfer soils formed in these areas.

Some of the glacial material or alluvium was redistributed by wind as loess (*3*). Bryant, Grassna, Omio, Temvik, and Wilton soils formed in loess.

Most of the preglacial bedrock formations in Emmons County are covered with glacial till, recent alluvium, or loess. In the western part of the county, however, the bedrock is exposed. The soils in these areas are gently sloping to steep. Amor, Cabba, Cohagen, Flasher, Reeder, and Vebar soils formed in material weathered from bedrock.

Recent alluvium covers the flood plains along the streams in the county. Neche Variant and Straw soils formed in recent alluvium.

Some of the soils formed in material that is high in content of sodium and salts. Examples are Belfield, Daglum, Harriet, Niobell, Noonan, and Rhoades soils.

Climate

Emmons County is warm in summer and cold in winter. The average annual precipitation is about 17 inches, more than three-fourths of which falls during the growing season.

Rainfall and temperature directly affect soil formation by weathering parent material and by leaching and redistributing carbonates, clay particles, and other substances in the soil profile. The older soils are leached of carbonates to a depth of about 10 to 30 inches. Examples are Bowbells and Williams soils.

Plant and animal life

The native vegetation in Emmons County is chiefly short, mid, and tall grasses. The composition of these grasses varies from site to site. In swales, which receive extra moisture, the dominant species are tall and mid grasses, including green needlegrass, western wheatgrass, needleandthread, prairie sandreed, and big bluestem. On excessively drained soils, such as those on ridgetops, the dominant species are short grasses, including blue grama, plains muhly, little bluestem, and threadleaf sedge. The dominant species in poorly drained areas are prairie cordgrass, rivergrass, reed canarygrass, switchgrass, and cattails.

The native vegetation produced a large amount of organic matter that decayed and was incorporated into the soil. Organic matter accumulated, for example, in Arnegard, Grail, and Grassna soils. In addition, the roots penetrated the soil and brought up calcium, phosphorous, potassium, and other nutrients. These materials were left near the surface when the plants decayed.

Bacteria and other minute organisms aid in the formation of humus by breaking down plant and animal remains. Earthworms, some insects, and rodents also affect soil formation.

Relief

Relief affects soil formation in several ways. Water stands in some depressions part or all of the year because of relief patterns. The soils in these areas are poorly drained or very poorly drained. They have many properties that differ from those of other soils, including arrangement of soil horizons and mottles in the subsoil. Tonka and Parnell soils are examples.

Nearly level to strongly sloping soils are common in the county. Those on the tops of sharp ridges and knolls, where drainage is excessive, are shallow, have a low content of organic matter, and have lime near the surface. Examples are Cabba, Cohagen, and Flasher soils.

Time

The soils in the county range from young to old. Williams soils are considered one of the oldest soils in the county. They formed in glacial till and are dark colored, are moderate in organic matter content, and have prismatic structure in the subsoil. Leaching has caused a noticeable increase in the content of fine clay particles in the subsoil and the accumulation of lime in a layer at a depth of 10 to 30 inches.

At the other extreme are the young soils that formed in alluvium on flood plains along streams. These soils show little evidence of leaching or horizonation. Straw soils are an example. They do not have a layer in which lime or clay has accumulated.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally

are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fine textured soil. Sandy clay, silty clay, and clay.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from

that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are

active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature*						Precipitation*				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days**	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	20.7	-3.4	8.7	52	-41	0	.51	.19	.76	3	7.1
February---	27.8	3.4	15.6	54	-32	9	.45	.18	.66	2	6.3
March------	38.6	15.1	26.9	71	-22	59	.78	.20	1.24	3	6.8
April------	56.6	29.9	43.2	86	6	155	1.97	.69	2.99	5	3.2
May--------	70.4	41.6	53.8	93	20	616	2.70	1.59	3.69	6	.5
June-------	79.4	51.5	65.5	99	33	765	3.61	1.77	5.10	8	.0
July-------	86.8	56.4	71.6	105	38	980	2.19	.86	3.26	6	.0
August-----	86.9	54.7	70.8	105	36	955	1.68	.76	2.41	5	.0
September--	74.2	42.9	58.6	99	20	558	1.53	.61	2.26	4	.0
October----	62.8	32.2	47.5	90	11	261	.87	.22	1.38	3	.5
November---	42.1	17.4	29.8	71	-13	32	.51	.05	.85	2	3.2
December---	27.4	4.5	16.0	56	-30	12	.52	.23	.74	2	6.1
Year-----	56.1	28.9	42.3	106	-41	4,402	17.32	14.20	20.29	49	33.7

* Recorded in the period 1951-75 at Linton, N. Dak.

** A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature*		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 19	May 29	June 4
2 years in 10 later than--	May 13	May 23	May 30
5 years in 10 later than--	May 2	May 13	May 19
First freezing temperature in fall:			
1 year in 10 earlier than--	September 17	September 10	August 10
2 years in 10 earlier than--	September 23	September 15	August 19
5 years in 10 earlier than--	October 4	September 27	September 7

* Recorded in the period 1951-75 at Linton, N. Dak.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season*		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	134	111	74
8 years in 10	141	119	87
5 years in 10	154	136	111
2 years in 10	167	152	135
1 year in 10	174	161	148

* Recorded in the period 1951-75 at Linton, N. Dak.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
3	Regan silt loam	3,020	0.3
6B	Niobell loam, 1 to 6 percent slopes	7,040	0.7
8	Heil silt loam	3,510	0.4
9	Tonka silt loam	3,930	0.4
10	Parnell silt loam	9,360	0.9
11	Straw silt loam, channeled	5,270	0.5
12	Neche Variant loam	1,820	0.2
13	Arnegard loam, 1 to 3 percent slopes	12,870	1.3
13B	Arnegard loam, 3 to 6 percent slopes	2,850	0.3
15D	Cabba-Amor loams, 9 to 15 percent slopes	9,300	0.9
15E	Cabba-Amor loams, 15 to 50 percent slopes	45,280	4.5
17	Stady-Lehr loams, 1 to 3 percent slopes	13,890	1.4
17B	Stady-Lehr loams, 3 to 6 percent slopes	11,910	1.2
17C	Stady-Lehr loams, 6 to 9 percent slopes	2,720	0.3
18B	Reeder-Rhoades silt loams, 3 to 6 percent slopes	1,530	0.2
18C	Reeder-Rhoades silt loams, 6 to 9 percent slopes	1,020	0.1
19	Straw silt loam, 1 to 3 percent slopes	15,510	1.6
21	Shambo loam, 1 to 3 percent slopes	5,160	0.5
21B	Shambo loam, 3 to 6 percent slopes	2,250	0.2
22	Belfield-Daglum silt loams, 1 to 3 percent slopes	11,550	1.2
22B	Belfield-Daglum silt loams, 3 to 6 percent slopes	8,800	0.9
23D	Vebar-Cohagen fine sandy loams, 9 to 15 percent slopes	9,830	1.0
23E	Vebar-Cohagen fine sandy loams, 15 to 50 percent slopes	16,500	1.7
24	Grassna silt loam, 1 to 3 percent slopes	26,810	2.7
24B	Grassna silt loam, 3 to 6 percent slopes	9,580	1.0
25B	Flaxton fine sandy loam, 1 to 6 percent slopes	11,780	1.2
25C	Flaxton fine sandy loam, 6 to 9 percent slopes	2,100	0.2
25D	Flaxton fine sandy loam, 9 to 15 percent slopes	1,020	0.1
26B	Krem loamy fine sand, 1 to 6 percent slopes	3,660	0.4
26C	Krem loamy fine sand, 6 to 9 percent slopes	730	0.1
28	Grail silty clay loam, 1 to 3 percent slopes	5,310	0.5
29	Harriet silt loam	17,090	1.7
31	Parnell silty clay loam, ponded	2,010	0.2
32B	Lihen loamy fine sand, 1 to 6 percent slopes	19,360	1.9
32C	Lihen loamy fine sand, 6 to 9 percent slopes	5,000	0.5
33B	Parshall-Lihen fine sandy loams, 1 to 6 percent slopes	30,080	3.0
33C	Parshall-Lihen fine sandy loams, 6 to 9 percent slopes	5,580	0.6
35C	Sutley silt loam, 3 to 9 percent slopes	2,900	0.3
35E	Sutley silt loam, 9 to 35 percent slopes	2,040	0.2
36B	Bryant silt loam, 3 to 6 percent slopes	44,180	4.2
36C	Bryant silt loam, 6 to 9 percent slopes	8,300	0.8
40C	Amor-Cabba loams, 6 to 9 percent slopes	6,420	0.6
40D	Amor-Cabba loams, 9 to 15 percent slopes	11,690	1.2
41	Reeder loam, 1 to 3 percent slopes	1,120	0.1
41B	Reeder loam, 3 to 6 percent slopes	13,870	1.4
41C	Reeder loam, 6 to 9 percent slopes	8,290	0.8
41D	Reeder loam, 9 to 15 percent slopes	1,510	0.2
43D	Reeder extremely stony loam, 1 to 15 percent slopes	670	0.1
44	Daglum-Rhoades silt loams, 1 to 3 percent slopes	11,640	1.2
44C	Daglum-Rhoades silt loams, 3 to 9 percent slopes	16,120	1.6
46B	Regent-Daglum silty clay loams, 3 to 6 percent slopes	2,320	0.2
46C	Regent-Daglum silty clay loams, 6 to 9 percent slopes	2,060	0.2
47B	Manning fine sandy loam, 1 to 6 percent slopes	6,730	0.7
49B	Telfer loamy fine sand, 1 to 6 percent slopes	3,100	0.3
51B	Noonan loam, 1 to 6 percent slopes	9,880	1.0
53	Bearpaw silt loam, 1 to 3 percent slopes	5,410	0.5
53B	Bearpaw silt loam, 3 to 6 percent slopes	13,600	1.4
53C	Bearpaw silt loam, 6 to 9 percent slopes	3,840	0.4
54	Regent silty clay loam, 1 to 3 percent slopes	510	0.1
54B	Regent silty clay loam, 3 to 6 percent slopes	3,450	0.3
54C	Regent silty clay loam, 6 to 9 percent slopes	1,950	0.2
54D	Regent silty clay loam, 9 to 15 percent slopes	560	0.1
55C	Rhoades silt loam, 1 to 9 percent slopes	15,620	1.6
58	Bowdle loam, 1 to 3 percent slopes	2,670	0.3
58B	Bowdle loam, 3 to 6 percent slopes	960	0.1
60B	Farland silt loam, 1 to 6 percent slopes	2,500	0.3
62	Amor loam, 1 to 3 percent slopes	4,250	0.4
62B	Amor loam, 3 to 6 percent slopes	28,010	2.8
62C	Amor loam, 6 to 9 percent slopes	20,700	2.1
62D	Amor loam, 9 to 15 percent slopes	3,670	0.4
63D	Wabek loam, 6 to 15 percent slopes	6,280	0.6
64	Wilton silt loam, 1 to 3 percent slopes	24,210	2.4

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
64B	Temvik silt loam, 3 to 6 percent slopes	43,020	4.1
64C	Temvik silt loam, 6 to 9 percent slopes	8,100	0.8
66C	Seroco fine sand, 1 to 9 percent slopes	3,590	0.4
66E	Seroco fine sand, 3 to 35 percent slopes	3,110	0.3
67B	Vebar fine sandy loam, 1 to 6 percent slopes	18,490	1.9
67C	Vebar fine sandy loam, 6 to 9 percent slopes	19,090	1.9
67D	Vebar fine sandy loam, 9 to 15 percent slopes	5,480	0.5
70	Williams-Bowbells loams, 1 to 3 percent slopes	11,520	1.2
70B	Williams-Bowbells loams, 3 to 6 percent slopes	52,710	5.3
70C	Williams loam, 6 to 9 percent slopes	13,040	1.3
72	Williams-Reeder loams, 1 to 3 percent slopes	950	0.1
72B	Williams-Reeder loams, 3 to 6 percent slopes	7,460	0.7
72C	Williams-Reeder loams, 6 to 9 percent slopes	4,800	0.5
73C	Williams-Zahl loams, 6 to 9 percent slopes	12,120	1.2
73E	Williams-Zahl loams, 9 to 25 percent slopes	14,600	1.5
79D	Telfer-Flasher loamy fine sands, 6 to 15 percent slopes	4,220	0.4
79E	Flasher-Telfer loamy fine sands, 15 to 35 percent slopes	10,140	1.0
82	Arveson loam	2,370	0.2
84	Havrelon Variant silt loam	620	0.1
85	Hamerly loam, 1 to 3 percent slopes	1,360	0.1
88	Lallie silt loam	2,270	0.2
93B	Ekalaka fine sandy loam, 1 to 6 percent slopes	690	0.1
98	Banks Variant very fine sandy loam	590	0.1
162	Omio-Grassna silt loams, 0 to 3 percent slopes	8,190	0.8
162B	Omio-Amor silt loams, 3 to 6 percent slopes	30,500	3.1
162C	Omio-Amor silt loams, 6 to 9 percent slopes	11,800	1.2
164	Williams-Falkirk loams, 1 to 3 percent slopes	12,610	1.3
164B	Williams-Falkirk loams, 3 to 6 percent slopes	22,420	2.2
	Water	35,840	3.6
	Total	997,760	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only arable soils are listed]

Soil name and map symbol	Spring wheat	Oats	Barley	Flax	Grass-legume hay
	Bu	Bu	Bu	Bu	Ton
3 Regan	21	42	36	11	1.6
6B Niobell	26	52	44	13	1.9
9 Tonka	26	52	44	13	1.9
13 Arnegard	34	68	58	17	2.5
13B Arnegard	31	62	53	15	2.3
17 Stady-Lehr	18	36	31	9	1.4
17B Stady-Lehr	15	30	26	7	1.1
17C Stady-Lehr	12	24	20	5	0.9
18B Reeder-Rhoades	22	44	37	10	1.6
18C Reeder-Rhoades	21	42	35	8	1.5
19 Straw	32	64	54	16	2.4
21 Shambo	29	58	49	14	2.1
21B Shambo	27	54	46	13	2.0
22 Belfield-Daglum	20	40	34	10	1.5
22B Belfield-Daglum	19	38	32	9	1.4
24 Grassna	34	68	58	17	2.5
24B Grassna	31	62	53	15	2.2
25B Flaxton	23	46	39	12	1.8
25C Flaxton	19	38	32	9	1.4
26B Krem	18	36	31	8	1.2

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Spring wheat	Oats	Barley	Flax	Grass-legume hay
	Bu	Bu	Bu	Bu	Ton
26C Krem	---	---	---	---	1.0
28 Grail	34	68	58	17	2.5
32B Lihen	13	26	22	7	1.0
33B Parshall-Lihen	20	41	35	10	1.5
33C Parshall-Lihen	18	36	31	8	1.2
35C Sutley	12	24	20	6	1.2
36B Bryant	27	54	46	13	2.0
36C Bryant	21	42	36	11	1.6
40C Amor-Cabba	15	30	26	8	1.1
40D Amor-Cabba	12	24	20	6	0.9
41 Reeder	29	58	49	14	2.1
41B Reeder	27	54	46	13	2.0
41C Reeder	20	40	34	10	1.5
41D Reeder	15	30	26	8	1.1
44 Daglum-Rhoades	10	26	17	5	0.8
46B Regent-Daglum	20	40	34	10	1.5
46C Regent-Daglum	18	36	31	8	1.2
47B Manning	13	30	22	7	1.0
49B Telfer	12	28	20	6	0.9
51B Noonan	10	26	17	5	0.8
53 Bearpaw	29	58	49	14	2.1
53B Bearpaw	27	54	46	13	2.0

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Spring wheat	Oats	Barley	Flax	Grass-legume hay
	Bu	Bu	Bu	Bu	Ton
53C Bearpaw	20	40	34	10	1.5
54 Regent	29	58	49	14	2.1
54B Regent	27	54	46	13	2.0
54C Regent	21	42	36	11	1.6
58 Bowdle	21	42	36	11	1.6
58B Bowdle	19	38	32	9	1.4
60B Farland	27	54	46	13	2.0
62 Amor	27	54	46	13	2.0
62B Amor	23	46	39	11	1.6
62C Amor	18	36	30	8	1.2
62D Amor	11	22	19	5	0.9
64 Wilton	29	58	49	14	2.1
64B Temvik	27	54	46	13	2.0
64C Temvik	20	40	34	10	1.5
67B Vebar	21	42	36	11	1.6
67C Vebar	18	36	31	8	1.2
70 Williams-Bowbells	31	62	53	15	2.2
70B Williams-Bowbells	29	58	49	14	2.1
70C Williams	20	40	34	10	1.5
72 Williams-Reeder	29	58	49	14	2.1
72B Williams-Reeder	27	54	46	13	2.0
72C Williams-Reeder	20	40	34	10	1.5

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Spring wheat	Oats	Barley	Flax	Grass-legume hay
	Bu	Bu	Bu	Bu	Ton
73C Williams-Zahl	18	36	31	8	1.2
84 Havrelon Variant	29	58	49	14	2.1
85 Hamerly	29	58	49	14	2.1
93B Ekalaka	13	26	22	7	1.0
98 Banks Variant	11	22	19	---	0.8
162 Omio-Grassna	29	58	50	13	2.3
162B Omio-Amor	23	46	39	11	1.8
162C Omio-Amor	18	36	30	8	1.2
164 Williams-Falkirk	29	58	49	14	2.1
164B Williams-Falkirk	27	54	46	13	2.0

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo- sition
			Lb/acre		Pct
3: Regan	Wet Meadow	Favorable	4,900	Slim sedge	25
		Normal	4,300	Wooly sedge	25
		Unfavorable	3,700	Fescue sedge	5
				Baltic rush	5
				Common spikesedge	5
				Northern reedgrass	5
				Prairie cordgrass	5
8: Heil	Closed Depression	Favorable	3,000	Western wheatgrass	40
		Normal	2,600	Prairie cordgrass	15
		Unfavorable	2,200	Common spikesedge	10
				Kentucky bluegrass	5
				Inland saltgrass	5
9: Tonka	Wet Meadow	Favorable	4,000	Slim sedge	25
		Normal	3,400	Woolyfruit sedge	25
		Unfavorable	2,800	Straw sedge	5
				Baltic rush	5
				Common spikesedge	5
				Northern reedgrass	5
				Prairie cordgrass	5
10: Parnell	Wetland	Favorable	6,600	Slough sedge	40
		Normal	6,200	Rivergrass	30
		Unfavorable	5,800	Prairie cordgrass	10
				Northern reedgrass	10
11: Straw	Overflow	Favorable	2,900	Big bluestem	30
		Normal	2,600	Kentucky bluegrass	10
		Unfavorable	2,300	Porcupinegrass	7
				Little bluestem	5
				Green needlegrass	5
				Western wheatgrass	5
				Western snowberry	5
12: Neche Variant	Wet Meadow	Favorable	4,900	Woolyfruit sedge	50
		Normal	4,400	Prairie cordgrass	10
		Unfavorable	3,900	Reed canarygrass	5
				Northern reedgrass	5
15D*, 15E*:					
Cabba	Shallow	Favorable	1,800	Little bluestem	25
		Normal	1,500	Needleandthread	10
		Unfavorable	1,200	Prairie sandreed	10
				Threadleaf sedge	8
				Plains muhly	5
				Blue grama	5
				Western wheatgrass	5
Amor	Silty	Favorable	2,500	Western wheatgrass	25
		Normal	2,100	Needleandthread	15
		Unfavorable	1,700	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
17C*:					
Stady	Silty	Favorable	2,000	Western wheatgrass	25
		Normal	1,700	Needleandthread	15
		Unfavorable	1,400	Blue grama	13
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
17C*:					
Lehr	Shallow To Gravel	Favorable	1,900	Needleandthread	25
		Normal	1,600	Blue grama	20
		Unfavorable	1,200	Western wheatgrass	10
				Pennsylvania sedge	10
				Plains muhly	5
23D*, 23E*:					
Vebar	Sandy	Favorable	2,300	Needleandthread	25
		Normal	2,000	Prairie sandreed	15
		Unfavorable	1,700	Western wheatgrass	10
				Blue grama	10
				Pennsylvania sedge	10
				Prairie junegrass	5
Cohagen	Shallow	Favorable	1,700	Little bluestem	25
		Normal	1,400	Needleandthread	10
		Unfavorable	1,100	Prairie sandreed	10
				Threadleaf sedge	8
				Plains muhly	5
				Blue grama	5
				Western wheatgrass	5
25D Flaxton	Sandy	Favorable	2,800	Needleandthread	25
		Normal	2,400	Prairie sandreed	15
		Unfavorable	2,000	Western wheatgrass	10
				Pennsylvania sedge	10
				Blue grama	5
				Prairie junegrass	5
29 Harriet	Saline Lowland	Favorable	2,600	Western wheatgrass	35
		Normal	2,200	Inland saltgrass	20
		Unfavorable	1,800	Nuttall alkaligrass	15
				Slender wheatgrass	5
35C, 35E Sutley	Silty	Favorable	2,800	Little bluestem	25
		Normal	2,300	Western wheatgrass	25
		Unfavorable	1,600	Needleandthread	20
				Sideoats grama	15
				Blue grama	10
				Sedge	5
40C*, 40D*:					
Amor	Silty	Favorable	2,500	Western wheatgrass	25
		Normal	2,100	Needleandthread	15
		Unfavorable	1,700	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Cabba	Shallow	Favorable	1,800	Little bluestem	25
		Normal	1,500	Needleandthread	10
		Unfavorable	1,200	Prairie sandreed	10
				Threadleaf sedge	8
				Plains muhly	5
				Blue grama	5
				Western wheatgrass	5
41D Reeder	Silty	Favorable	2,300	Western wheatgrass	25
		Normal	1,900	Needleandthread	15
		Unfavorable	1,500	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
43D------ Reeder	Silty	Favorable	2,500	Western wheatgrass	25
		Normal	2,100	Needleandthread	15
		Unfavorable	1,500	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
44*, 44C*:					
Daglum	Claypan	Favorable	2,000	Western wheatgrass	40
		Normal	1,600	Blue grama	25
		Unfavorable	1,200	Prairie junegrass	5
				Needleandthread	5
				Green needlegrass	5
Rhoades	Thin Claypan	Favorable	800	Western wheatgrass	35
		Normal	600	Blue grama	30
		Unfavorable	400	Sandberg bluegrass	5
				Prairie junegrass	5
				Fringed sagebrush	5
46C*:					
Regent	Clayey	Favorable	2,200	Western wheatgrass	40
		Normal	1,800	Green needlegrass	10
		Unfavorable	1,400	Blue grama	10
				Prairie junegrass	5
				Plains reedgrass	5
Daglum	Claypan	Favorable	2,000	Western wheatgrass	40
		Normal	1,600	Blue grama	25
		Unfavorable	1,200	Prairie junegrass	5
				Needleandthread	5
				Green needlegrass	5
51B------ Noonan	Claypan	Favorable	2,000	Western wheatgrass	40
		Normal	1,700	Blue grama	20
		Unfavorable	1,300	Green needlegrass	5
				Needleandthread	5
				Prairie junegrass	5
				Pennsylvania sedge	5
53C------ Bearpaw	Clayey	Favorable	2,500	Western wheatgrass	40
		Normal	2,000	Green needlegrass	10
		Unfavorable	1,500	Blue grama	10
				Prairie junegrass	5
54C, 54D------ Regent	Clayey	Favorable	2,150	Western wheatgrass	40
		Normal	1,800	Green needlegrass	10
		Unfavorable	1,450	Blue grama	10
				Prairie junegrass	5
				Plains reedgrass	5
55C------ Rhoades	Thin Claypan	Favorable	800	Western wheatgrass	35
		Normal	600	Blue grama	30
		Unfavorable	400	Sandberg bluegrass	5
				Prairie junegrass	5
				Fringed sagebrush	5
62D------ Amor	Silty	Favorable	2,500	Western wheatgrass	25
		Normal	2,100	Needleandthread	15
		Unfavorable	1,700	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
63D------ Wabek	Very Shallow	Favorable	800	Needleandthread	25
		Normal	700	Blue grama	15
		Unfavorable	600	Western wheatgrass	15
				Threadleaf sedge	8
				Plains muhly	5
				Prairie junegrass	5
				Red threeawn	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
66C, 66E----------- Seroco	Thin Sands---------------------	Favorable Normal Unfavorable	2,000 1,700 1,300	Prairie sandreed-------------- Needleandthread--------------- Sand bluestem----------------- Blue grama-------------------- Pennsylvania sedge------------ Green sagewort----------------	30 20 5 5 5 5
67C, 67D----------- Vebar	Sandy--------------------------	Favorable Normal Unfavorable	2,300 2,000 1,700	Needleandthread--------------- Prairie sandreed-------------- Western wheatgrass------------ Blue grama-------------------- Pennsylvania sedge------------ Prairie junegrass-------------	25 15 10 10 10 5
72C*:					
Williams----------	Silty--------------------------	Favorable Normal Unfavorable	2,700 2,300 1,800	Western wheatgrass------------ Needleandthread--------------- Green needlegrass------------- Prairie junegrass------------- Blue grama-------------------- Pennsylvania sedge------------	20 15 10 10 10 5
Reeder------------	Silty--------------------------	Favorable Normal Unfavorable	2,300 1,900 1,500	Western wheatgrass------------ Needleandthread--------------- Blue grama-------------------- Green needlegrass------------- Prairie junegrass------------- Kentucky bluegrass------------	25 15 15 7 5 5
73E*:					
Williams----------	Silty--------------------------	Favorable Normal Unfavorable	2,700 2,300 1,800	Western wheatgrass------------ Needleandthread--------------- Green needlegrass------------- Prairie junegrass------------- Blue grama-------------------- Pennsylvania sedge------------	20 15 10 10 10 5
Zahl--------------	Thin Upland--------------------	Favorable Normal Unfavorable	2,300 1,900 1,500	Little bluestem--------------- Western wheatgrass------------ Needleandthread--------------- Pennsylvania sedge------------ Sideoats grama---------------- Plains muhly------------------ Porcupinegrass---------------- Blue grama--------------------	20 10 10 8 5 5 5 5
79D*:					
Telfer------------	Sands--------------------------	Favorable Normal Unfavorable	2,500 2,100 1,700	Needleandthread--------------- Prairie sandreed-------------- Pennsylvania sedge------------ Blue grama-------------------- Western wheatgrass------------ Sand dropseed----------------- Sand bluestem----------------- Little bluestem---------------	25 15 10 8 5 5 5 5
Flasher-----------	Shallow------------------------	Favorable Normal Unfavorable	1,700 1,400 1,100	Little bluestem--------------- Prairie sandreed-------------- Needleandthread--------------- Threadleaf sedge-------------- Plains muhly------------------ Western wheatgrass------------ Blue grama--------------------	25 10 10 8 5 5 5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
79E*:					
Flasher	Shallow	Favorable	1,700	Little bluestem	25
		Normal	1,400	Prairie sandreed	10
		Unfavorable	1,100	Needleandthread	10
				Threadleaf sedge	8
				Plains muhly	5
				Western wheatgrass	5
				Blue grama	5
Telfer	Sands	Favorable	2,500	Needleandthread	25
		Normal	2,100	Prairie sandreed	15
		Unfavorable	1,700	Pennsylvania sedge	10
				Blue grama	8
				Western wheatgrass	5
				Sand dropseed	5
				Sand bluestem	5
				Little bluestem	5
82 Arveson	Subirrigated	Favorable	5,000	Big bluestem	25
		Normal	3,800	Reed canarygrass	10
		Unfavorable	3,400	Switchgrass	10
				Indiangrass	10
				Kentucky bluegrass	10
				Redtop	5
				Prairie cordgrass	5
93B Ekalaka	Sandy	Favorable	2,200	Prairie sandreed	20
		Normal	1,800	Needleandthread	20
		Unfavorable	1,400	Western wheatgrass	10
				Blue grama	10
				Prairie junegrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
3. Regan					
6B. Niobell	---	Eastern redcedar, Rocky Mountain juniper, Russian-olive, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian elm, green ash, American elm, ponderosa pine.	---	---
8. Heil					
9. Tonka					
10. Parnell					
11. Straw					
12. Neche Variant					
13, 13B. Arnegard	---	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.
15D*: Cabba.					
Amor	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.	---	---
15E*: Cabba.					
Amor.					
17*, 17B*, 17C*: Stady	Eastern redcedar, Siberian peashrub, Rocky Mountain juniper.	Ponderosa pine, Russian-olive, green ash.	Siberian elm	---	---
Lehr	Siberian peashrub, eastern redcedar, Rocky Mountain juniper.	Green ash, ponderosa pine, Russian-olive.	Siberian elm	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
18B*, 18C*: Reeder	---	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, Tatarian honeysuckle, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.	---	---
Rhoades.					
19 Straw	---	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.
21, 21B Shambo	---	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	---
22*, 22B*: Belfield	Tatarian honeysuckle, American plum.	American elm, ponderosa pine, Rocky Mountain juniper, Russian-olive, Siberian peashrub, common chokecherry.	Siberian elm, green ash.	---	---
Daglum.					
23D*: Vebar	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---	---
Cohagen.					
23E*: Vebar.					
Cohagen.					
24, 24B Grassna	---	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.
25B, 25C, 25D Flaxton	---	Siberian peashrub, eastern redcedar, Rocky Mountain juniper, common chokecherry, Tatarian honeysuckle, American plum.	Siberian elm, ponderosa pine, American elm, green ash, Russian-olive.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
26B, 26C Krem	American plum, common chokecherry, lilac, Tatarian honeysuckle.	Green ash, Russian-olive, Siberian peashrub.	Siberian elm, ponderosa pine.	---	---
28 Grail	---	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.
29. Harriet					
31. Parnell					
32B, 32C Lihen	Silver buffaloberry.	Siberian peashrub, Russian-olive, Rocky Mountain juniper.	Siberian elm	---	---
33B*, 33C*: Parshall	---	Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, blue spruce, green ash, ponderosa pine, common chokecherry, Rocky Mountain juniper, Russian-olive.	Siberian elm	Eastern cottonwood.
Lihen	Silver buffaloberry.	Siberian peashrub, Russian-olive, Rocky Mountain juniper.	Siberian elm	---	---
35C Sutley	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm	---	---
35E. Sutley					
36B, 36C Bryant	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
40C*, 40D*: Amor	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
40C*, 40D*: Cabba.					
41, 41B, 41C, 41D-Reeder	---	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, Tatarian honeysuckle, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.	---	---
43D. Reeder					
44*, 44C*: Daglum.					
Rhoades.					
46B*, 46C*: Regent	---	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, Tatarian honeysuckle.	Siberian elm, American elm, green ash.	---	---
Daglum.					
47B Manning	Siberian peashrub, eastern redcedar, Rocky Mountain juniper.	Green ash, ponderosa pine, Russian-olive.	Siberian elm	---	---
49B Telfer	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---	---
51B. Noonan					
53, 53B, 53C Bearpaw	---	Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, Rocky Mountain juniper.	Siberian elm, Russian-olive, ponderosa pine.	---	---
54, 54B, 54C Regent	---	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, Tatarian honeysuckle.	Siberian elm, American elm, green ash.	---	---
54D. Regent					
55C. Rhoades					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
58, 58B. Bowdle	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---
60B. Farland	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, American plum.	Siberian elm, American elm, green ash, blue spruce, ponderosa pine.	---	---
62, 62B, 62C, 62D. Amor	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.	---	---
63D. Wabek					
64. Wilton	---	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, blue spruce.	Siberian elm	---
64B, 64C. Temvik	---	Russian-olive, Siberian peashrub, eastern redcedar, Rocky Mountain juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, blue spruce.	Siberian elm	---
66C, 66E. Seroco					
67B, 67C. Vebar	---	American elm, green ash, Siberian peashrub, eastern redcedar, common chokecherry, American plum.	Siberian elm, ponderosa pine.	---	---
67D. Vebar	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
70*, 70B*: Williams	---	Eastern redcedar, Rocky Mountain juniper, blue spruce, Black Hills spruce, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine.	Siberian elm	---
Bowbells	---	Eastern redcedar, American plum, common chokecherry, Siberian peashrub.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce, Russian-olive.	Siberian elm	Eastern cottonwood.
70C Williams	---	Eastern redcedar, Rocky Mountain juniper, blue spruce, Black Hills spruce, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine.	Siberian elm	---
72*, 72B*, 72C*: Williams	---	Eastern redcedar, Rocky Mountain juniper, blue spruce, Black Hills spruce, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine.	Siberian elm	---
Reeder	---	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, Tatarian honeysuckle, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.	---	---
73C*: Williams	---	Eastern redcedar, Rocky Mountain juniper, blue spruce, Black Hills spruce, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine.	Siberian elm	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
73C*: Zahl	Siberian peashrub	Ponderosa pine, Siberian elm, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	---	---	---
73E*: Williams	---	Eastern redcedar, Rocky Mountain juniper, blue spruce, Black Hills spruce, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine.	Siberian elm	---
Zahl.					
79D*: Telfer.					
Flasher.					
79E*: Flasher.					
Telfer.					
82. Arveson					
84 Havrelon Variant	---	Siberian crabapple, common chokecherry, eastern redcedar, Siberian peashrub, American plum, Tatarian honeysuckle, Peking cotoneaster.	Golden willow, green ash, ponderosa pine, Black Hills spruce.	---	Plains cottonwood.
85 Hamerly	---	Eastern redcedar, American plum, common chokecherry, Siberian peashrub.	Ponderosa pine, Black Hills spruce, blue spruce, Russian-olive.	Siberian elm, American elm, green ash.	Eastern cottonwood.
88. Lallie					
93B. Ekalaka					
98 Banks Variant	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
162*:					
Omio	---	American plum, eastern redcedar, Rocky Mountain juniper, blue spruce, Black Hills spruce, Siberian peashrub, common chokecherry, Tatarian honeysuckle.	Green ash, ponderosa pine.	Siberian elm	---
Grassna	---	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.
162B*, 162C*:					
Omio	---	American plum, eastern redcedar, Rocky Mountain juniper, blue spruce, Black Hills spruce, Siberian peashrub, common chokecherry, Tatarian honeysuckle.	Green ash, ponderosa pine.	Siberian elm	---
Amor	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.	---	---
164*, 164B*:					
Williams	---	Eastern redcedar, Rocky Mountain juniper, blue spruce, Black Hills spruce, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine.	Siberian elm	---
Falkirk	---	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mountain juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, blue spruce.	Siberian elm	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
3 Regan	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
6B Niobell	Slight	Slight	Moderate: slope.	Slight.
8 Heil	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
9 Tonka	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
10 Parnell	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
11 Straw	Severe: floods.	Slight	Slight	Slight.
12 Neche Variant	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
13, 13B Arnegard	Slight	Slight	Moderate: slope.	Slight.
15D*:				
Cabba	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope, depth to rock.	Moderate: dusty.
Amor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
15E*:				
Cabba	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.
Amor	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
17*, 17B*:				
Stady	Slight	Slight	Moderate: slope.	Slight.
Lehr	Slight	Slight	Moderate: slope.	Slight.
17C*:				
Stady	Slight	Slight	Severe: slope.	Slight.
Lehr	Slight	Slight	Severe: slope.	Slight.
18B*:				
Reeder	Slight	Slight	Moderate: depth to rock, slope.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
18B*:				
Rhoades	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
18C*:				
Reeder	Slight	Slight	Severe: slope.	Slight.
Rhoades	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight.
19 Straw	Severe: floods.	Slight	Moderate: slope.	Slight.
21, 21B Shambo	Slight	Slight	Moderate: slope.	Slight.
22*, 22B*:				
Belfield	Slight	Slight	Moderate: slope, percs slowly.	Slight.
Daglum	Moderate: percs slowly.	Slight	Severe: percs slowly.	Slight.
23D*:				
Vebar	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Cohagen	Severe: depth to rock.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
23E*:				
Vebar	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Cohagen	Severe: slope, depth to rock.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.
24, 24B Grassna	Slight	Slight	Moderate: slope.	Slight.
25B Flaxton	Slight	Slight	Moderate: slope.	Slight.
25C Flaxton	Slight	Slight	Severe: slope.	Slight.
25D Flaxton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
26B Krem	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
26C Krem	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
28 Grail	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
29 Harriet	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
31 Parnell	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
32B Lihen	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
32C Lihen	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
33B*:				
Parshall	Slight	Slight	Moderate: slope.	Slight.
Lihen	Slight	Slight	Moderate: slope.	Slight.
33C*:				
Parshall	Slight	Slight	Severe: slope.	Slight.
Lihen	Slight	Slight	Severe: slope.	Slight.
35C Sutley	Slight	Slight	Severe: slope.	Slight.
35E Sutley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
36B Bryant	Slight	Slight	Moderate: slope.	Slight.
36C Bryant	Slight	Slight	Severe: slope.	Slight.
40C*:				
Amor	Slight	Slight	Severe: slope.	Slight.
Cabba	Moderate: dusty.	Moderate: dusty.	Severe: slope, depth to rock.	Moderate: dusty.
40D*:				
Amor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Cabba	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope, depth to rock.	Moderate: dusty.
41, 41B Reeder	Slight	Slight	Moderate: depth to rock, slope.	Slight.
41C Reeder	Slight	Slight	Severe: slope.	Slight.
41D, 43D Reeder	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
44*:				
Daglum	Moderate: percs slowly.	Slight	Severe: percs slowly.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
44*:				
Rhoades	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
44C*:				
Daglum	Moderate: percs slowly.	Slight	Severe: slope, percs slowly.	Slight.
Rhoades	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight.
46B*:				
Regent	Slight	Slight	Moderate: slope.	Slight.
Daglum	Moderate: percs slowly.	Slight	Severe: percs slowly.	Slight.
46C*:				
Regent	Slight	Slight	Severe: slope.	Slight.
Daglum	Moderate: percs slowly.	Slight	Severe: slope, percs slowly.	Slight.
47B Manning	Slight	Slight	Moderate: slope.	Slight.
49B Telfer	Slight	Slight	Moderate: slope.	Slight.
51B Noonan	Slight	Slight	Moderate: slope.	Slight.
53, 53B Bearpaw	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
53C Bearpaw	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
54, 54B Regent	Slight	Slight	Moderate: slope.	Slight.
54C Regent	Slight	Slight	Severe: slope.	Slight.
54D Regent	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
55C Rhoades	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
58, 58B Bowdle	Slight	Slight	Moderate: slope.	Slight.
60B Farland	Slight	Slight	Moderate: slope.	Slight.
62, 62B Amor	Slight	Slight	Moderate: slope, depth to rock.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
62C----- Amor	Slight-----	Slight-----	Severe: slope.	Slight.
62D----- Amor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
63D----- Wabek	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
64----- Wilton	Slight-----	Slight-----	Moderate: slope.	Slight.
64B----- Temvik	Slight-----	Slight-----	Moderate: slope, percs slowly.	Slight.
64C----- Temvik	Slight-----	Slight-----	Severe: slope.	Slight.
66C----- Seroco	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
66E----- Seroco	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
67B----- Vebar	Slight-----	Slight-----	Moderate: depth to rock, slope.	Slight.
67C----- Vebar	Slight-----	Slight-----	Severe: slope.	Slight.
67D----- Vebar	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
70*, 70B*:				
Williams-----	Slight-----	Slight-----	Moderate: slope.	Slight.
Bowbells-----	Slight-----	Slight-----	Moderate: slope.	Slight.
70C----- Williams	Slight-----	Slight-----	Severe: slope.	Slight.
72*, 72B*:				
Williams-----	Slight-----	Slight-----	Moderate: slope.	Slight.
Reeder-----	Slight-----	Slight-----	Moderate: depth to rock, slope.	Slight.
72C*:				
Williams-----	Slight-----	Slight-----	Severe: slope.	Slight.
Reeder-----	Slight-----	Slight-----	Severe: slope.	Slight.
73C*:				
Williams-----	Slight-----	Slight-----	Severe: slope.	Slight.
Zahl-----	Slight-----	Slight-----	Severe: slope.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
73E*:				
Williams	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Zahl	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
79D*:				
Telfer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Flasher	Severe: depth to rock.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
79E*:				
Flasher	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
Telfer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
82 Arveson	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.
84 Havrelon Variant	Severe: floods.	Moderate: floods, wetness.	Severe: floods.	Moderate: floods.
85 Hamerly	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight.
88 Lallie	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
93B Ekalaka	Slight	Slight	Moderate: slope.	Slight.
98 Banks Variant	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
162*:				
Omio	Slight	Slight	Slight	Slight.
Grassna	Slight	Slight	Slight	Slight.
162B*:				
Omio	Slight	Slight	Moderate: slope.	Slight.
Amor	Slight	Slight	Moderate: slope, depth to rock.	Slight.
162C*:				
Omio	Slight	Slight	Severe: slope.	Slight.
Amor	Slight	Slight	Severe: slope.	Slight.
164*, 164B*:				
Williams	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
164*, 164B*:				
Falkirk	Slight	Slight	Moderate: slope.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
3: Regan	Poor	Fair	Fair	Fair	Good	Good	Fair	Good	Fair.
6B: Niobell	Fair	Fair	Good	Poor	Poor	Very poor.	Fair	Very poor	Fair.
8: Heil	Poor	Poor	Fair	Very poor.	Good	Good	Poor	Good	Poor.
9: Tonka	Poor	Poor	Fair	Poor	Good	Good	Poor	Good	Poor.
10: Parnell	Very poor	Poor	Poor	Poor	Good	Good	Poor	Good	Poor.
11: Straw	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
12: Neche Variant	Very poor	Very poor.	Poor	Fair	Good	Good	Very poor	Good	Very poor.
13: Arnegard	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor	Good.
13B: Arnegard	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
15D*:									
Cabba	Poor	Fair	Fair	Fair	---	---	Fair	---	Fair.
Amor	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
15E*:									
Cabba	Very poor	Very poor.	Fair	Fair	---	---	Poor	---	Fair.
Amor	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
17*, 17B*:									
Stady	Fair	Fair	Good	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Lehr	Fair	Good	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Fair.
17C*:									
Stady	Poor	Fair	Good	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Lehr	Fair	Good	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Fair.
18B*:									
Reeder	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Very poor	Fair.
Rhoades	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor	Poor	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
18C*:									
Reeder	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Rhoades	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor	Poor	Very poor.
19 Straw	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Very poor	Fair.
21, 21B Shambo	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
22*:									
Belfield	Fair	Good	Fair	Poor	Poor	Very poor.	Fair	Very poor	Fair.
Daglum	Fair	Good	Fair	Very poor.	Poor	Poor	Fair	Poor	Poor.
22B*:									
Belfield	Fair	Good	Fair	Poor	Poor	Very poor.	Fair	Very poor	Fair.
Daglum	Fair	Good	Fair	Very poor.	Poor	Very poor.	Fair	Very poor	Poor.
23D*:									
Vebar	Poor	Fair	Good	Very poor.	Very poor.	Very poor.	Fair	Very poor	Good.
Cohagen	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Poor.
23E*:									
Vebar	Very poor	Poor	Good	Very poor.	Very poor.	Very poor.	Poor	Very poor	Good.
Cohagen	Very poor	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
24, 24B Grassna	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor	Fair.
25B, 25C Flaxton	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
25D Flaxton	Poor	Fair	Good	Fair	Poor	Very poor.	Fair	Very poor	Fair.
26B Krem	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
26C Krem	Poor	Fair	Good	Fair	Poor	Very poor.	Fair	Very poor	Fair.
28 Grail	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor	Fair.
29 Harriet	Poor	Poor	Fair	Very poor.	Good	Good	Poor	Good	Poor.
31 Parnell	Very poor	Poor	Poor	Poor	Good	Good	Poor	Good	Poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
32B, 32C: Lihen	Fair	Fair	Good	Good	---	---	Fair	---	Good.
33B*, 33C*:									
Parshall	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Lihen	Fair	Fair	Good	Good	---	---	Fair	---	Good.
35C: Sutley	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
35E: Sutley	Very poor	Fair	Poor	Fair	Very poor.	Very poor.	Very poor	Very poor	Fair.
36B: Bryant	Good	Good	Good	---	Very poor.	Very poor.	Good	Very poor	Good.
36C: Bryant	Fair	Good	Good	---	Very poor.	Very poor.	Fair	Very poor	Good.
40C*, 40D*:									
Amor	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Cabba	Poor	Fair	Fair	Fair	---	---	Fair	---	Fair.
41, 41B: Reeder	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Very poor	Fair.
41C, 41D: Reeder	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
43D: Reeder	Very poor	Very poor.	Good	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
44*:									
Daglum	Fair	Good	Fair	Very poor.	Poor	Poor	Fair	Poor	Poor.
Rhoades	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor	Poor	Very poor.
44C*:									
Daglum	Fair	Good	Fair	Very poor.	Poor	Very poor.	Fair	Very poor	Poor.
Rhoades	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor	Poor	Very poor.
46B*, 46C*:									
Regent	Fair	Good	Fair	Poor	Poor	Very poor.	Fair	Very poor	Poor.
Daglum	Fair	Good	Fair	Very poor.	Poor	Very poor.	Fair	Very poor	Poor.
47B: Manning	Fair	Good	Good	Poor	Very poor.	Very poor.	Fair	Very poor	Fair.
49B: Telfer	Fair	Good	Good	Fair	Very poor.	Very poor.	Good	Very poor	Fair.
51B: Noonan	Poor	Poor	Very poor	Very poor.	Poor	Very poor.	Poor	Very poor	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
53, 53B, 53C------- Bearpaw	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
54, 54B, 54C------- Regent	Fair	Good	Fair	Poor	Poor	Very poor.	Fair	Very poor	Poor.
54D---------------- Regent	Poor	Fair	Poor	Very poor.	Poor	Very poor.	Poor	Very poor	Poor.
55C---------------- Rhoades	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor	Poor	Very poor.
58, 58B------------ Bowdle	Fair	Fair	Good	---	Very poor.	Very poor.	Fair	Very poor	Good.
60B---------------- Farland	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor	Fair.
62, 62B, 62C, 62D-- Amor	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
63D---------------- Wabek	Very poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
64----------------- Wilton	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor	Fair.
64B---------------- Temvik	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor	Fair.
64C---------------- Temvik	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
66C---------------- Seroco	Poor	Fair	Fair	Good	Very poor.	Very poor.	Fair	Very poor	Fair.
66E---------------- Seroco	Very poor	Very poor.	Fair	Good	Very poor.	Very poor.	Poor	Very poor	Fair.
67B, 67C----------- Vebar	Fair	Good	Good	Very poor.	Poor	Very poor.	Good	Very poor	Good.
67D---------------- Vebar	Poor	Fair	Good	Very poor.	Very poor.	Very poor.	Fair	Very poor	Good.
70*:									
Williams----------	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Bowbells----------	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
70B*:									
Williams----------	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Bowbells----------	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
70C---------------- Williams	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
72*, 72B*:									
Williams----------	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
72*, 72B*:									
Reeder------------	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Very poor	Fair.
72C*:									
Williams----------	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Reeder------------	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
73C*:									
Williams----------	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Zahl--------------	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
73E*:									
Williams----------	Fair	Good	Good	Fair	Very poor.	Very poor.	Good	Very poor	Fair.
Zahl--------------	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
79D*:									
Telfer------------	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Flasher-----------	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Poor.
79E*:									
Flasher-----------	Very poor	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Telfer------------	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
82----------------- Arveson	Fair	Fair	Fair	---	Good	Good	Fair	Poor	---
84----------------- Havrelon Variant	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
85----------------- Hamerly	Good	Good	Good	Fair	Fair	Poor	Good	Poor	Fair.
88----------------- Lallie	Very poor	Fair	Fair	Poor	Poor	Good	Poor	Fair	Poor.
93B---------------- Ekalaka	Fair	Good	Poor	Fair	Poor	Very poor.	Fair	Very poor	Poor.
98----------------- Banks Variant	Fair	Good	Fair	Good	Fair	Fair	Fair	Fair	Fair.
162*:									
Omio---------------	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor	Fair.
Grassna------------	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
162B*:									
Omio----------------	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor	Fair.
Amor----------------	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
162C*:									
Omio----------------	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Amor----------------	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
164*, 164B*:									
Williams------------	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Falkirk-------------	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
3 Regan	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, low strength.
6B Niobell	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
8 Heil	Severe: too clayey, wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
9 Tonka	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
10 Parnell	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, low strength.
11 Straw	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, frost action, floods.
12 Neche Variant	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
13 Arnegard	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.
13B Arnegard	Slight	Moderate: shrink-swell.	Slight	Moderate: slope, shrink-swell.	Severe: low strength.
15D*:					
Cabba	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.
Amor	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, depth to rock, slope.	Severe: slope.	Severe: low strength.
15E*:					
Cabba	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope, low strength.
Amor	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
17*:					
Stady	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action, low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
17*:					
Lehr	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
17B*, 17C*:					
Stady	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
Lehr	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
18B*, 18C*:					
Reeder	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.
Rhoades	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
19 Straw	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, frost action, floods.
21 Shambo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
21B Shambo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
22*, 22B*:					
Belfield	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Daglum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
23D*:					
Vebar	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.
Cohagen	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, frost action.
23E*:					
Vebar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cohagen	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
24 Grassna	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
24B Grassna	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
25B---------------- Flaxton	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
25C---------------- Flaxton	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
25D---------------- Flaxton	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
26B---------------- Krem	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action.
26C---------------- Krem	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action.
28----------------- Grail	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
29----------------- Harriet	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.
31----------------- Parnell	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, low strength.
32B---------------- Lihen	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight------------	Slight.
32C---------------- Lihen	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight.
33B*:					
Parshall----------	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: frost action, low strength.
Lihen-------------	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight------------	Slight.
33C*:					
Parshall----------	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action, low strength.
Lihen-------------	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight.
35C---------------- Sutley	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action, low strength.
35E---------------- Sutley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
36B, 36C----------- Bryant	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
40C*:					
Amor--------------	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
40C*:					
Cabba	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope.	Severe: low strength.
40D*:					
Amor	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, depth to rock, slope.	Severe: slope.	Severe: low strength.
Cabba	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.
41 Reeder	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell.	Severe: low strength.
41B, 41C Reeder	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.
41D Reeder	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope, depth to rock.	Severe: slope.	Severe: low strength.
43D Reeder	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, depth to rock, slope.	Severe: slope.	Severe: low strength.
44*:					
Daglum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Rhoades	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
44C*:					
Daglum	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Rhoades	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
46B*, 46C*:					
Regent	Moderate: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Daglum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
47B Manning	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
49B Telfer	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
51B Noonan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
53, 53B, 53C------ Bearpaw	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
54, 54B, 54C------ Regent	Moderate: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
54D--------------- Regent	Moderate: depth to rock, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
55C--------------- Rhoades	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
58---------------- Bowdle	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight------------	Slight.
58B--------------- Bowdle	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight.
60B--------------- Farland	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
62---------------- Amor	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell.	Severe: low strength.
62B, 62C---------- Amor	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.
62D--------------- Amor	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, depth to rock, slope.	Severe: slope.	Severe: low strength.
63D--------------- Wabek	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
64---------------- Wilton	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, low strength.
64B, 64C---------- Temvik	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
66C--------------- Seroco	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight.
66E--------------- Seroco	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
67B--------------- Vebar	Moderate: depth to rock.	Slight-----------	Moderate: depth to rock.	Slight------------	Slight.
67C--------------- Vebar	Moderate: depth to rock.	Slight-----------	Moderate: depth to rock.	Moderate: slope.	Slight.
67D--------------- Vebar	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
70*:					
Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Bowbells	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
70B*:					
Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Bowbells	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
70C Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
72*:					
Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Reeder	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell.	Severe: low strength.
72B*, 72C*:					
Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Reeder	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.
73C*:					
Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Zahl	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
73E*:					
Williams	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
Zahl	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
79D*:					
Telfer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Flasher	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock.
79E*:					
Flasher	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
79E*:					
Telfer	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
82 Arveson	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, wetness, frost action.
84 Havrelon Variant	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: low strength, floods.
85 Hamerly	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.
88 Lallie	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
93B Ekalaka	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
98 Banks Variant	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
162*:					
Omio	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Severe: low strength.
Grassna	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
162B*, 162C*:					
Omio	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Severe: low strength.
Amor	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.
164*:					
Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Falkirk	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.
164B*:					
Williams	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Falkirk	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
3 Regan	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
6B Niobell	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Poor: excess sodium.
8 Heil	Severe: percs slowly, wetness, floods.	Slight	Severe: too clayey, wetness, floods.	Severe: floods, wetness.	Poor: too clayey, wetness, excess sodium.
9 Tonka	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey, wetness.
10 Parnell	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
11 Straw	Moderate: floods, percs slowly.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Good.
12 Neche Variant	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
13, 13B Arnegard	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
15D*:					
Cabba	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Amor	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim.
15E*:					
Cabba	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
Amor	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: area reclaim, slope.
17*, 17B*:					
Stady	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy.
Lehr	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
17C*:					
Stady	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy.
Lehr	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy, small stones.
18B*:					
Reeder	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
Rhoades	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
18C*:					
Reeder	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
Rhoades	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
19 Straw	Moderate: floods, percs slowly.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Good.
21, 21B Shambo	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
22*, 22B*:					
Belfield	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Daglum	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
23D*:					
Vebar	Severe: depth to rock.	Severe: seepage, slope.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: area reclaim.
Cohagen	Severe: depth to rock.	Severe: seepage, slope, depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Poor: area reclaim.
23E*:					
Vebar	Severe: depth to rock, slope.	Severe: seepage, slope.	Severe: seepage, slope, depth to rock.	Severe: seepage, slope.	Poor: area reclaim, slope.
Cohagen	Severe: depth to rock, slope.	Severe: seepage, slope, depth to rock.	Severe: seepage, depth to rock, slope.	Severe: seepage, slope, depth to rock.	Poor: slope, area reclaim.
24, 24B Grassna	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
25B----------------- Flaxton	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey.	Severe: seepage.	Fair: too clayey.
25C----------------- Flaxton	Severe: percs slowly.	Severe: seepage, slope.	Moderate: too clayey.	Severe: seepage.	Fair: too clayey.
25D----------------- Flaxton	Severe: percs slowly.	Severe: seepage, slope.	Moderate: too clayey.	Severe: seepage.	Fair: slope, too clayey.
26B----------------- Krem	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey.	Severe: seepage.	Fair: too clayey.
26C----------------- Krem	Severe: percs slowly.	Severe: seepage, slope.	Moderate: too clayey.	Severe: seepage.	Fair: too clayey.
28------------------ Grail	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
29------------------ Harriet	Severe: percs slowly, wetness.	Slight-----------	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, excess sodium.
31------------------ Parnell	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
32B----------------- Lihen	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
32C----------------- Lihen	Slight-----------	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
33B*:					
Parshall-----------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Lihen--------------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
33C*:					
Parshall-----------	Slight-----------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
Lihen--------------	Slight-----------	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
35C----------------- Sutley	Slight-----------	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
35E----------------- Sutley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
36B----------------- Bryant	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
36C----------------- Bryant	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
40C*:					
Amor	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
Cabba	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
40D*:					
Amor	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim.
Cabba	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
41, 41B Reeder	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
41C Reeder	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
41D Reeder	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim.
43D Reeder	Severe: depth to rock, large stones.	Severe: slope.	Severe: depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim.
44*:					
Daglum	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
Rhoades	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
44C*:					
Daglum	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
Rhoades	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
46B*:					
Regent	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Moderate: depth to rock.	Poor: area reclaim, too clayey.
Daglum	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
46C*:					
Regent	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Moderate: depth to rock.	Poor: area reclaim, too clayey.
Daglum	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
47B----- Manning	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones, too sandy, seepage.
49B----- Telfer	Slight-----	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
51B----- Noonan	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Poor: excess sodium.
53, 53B----- Bearpaw	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
53C----- Bearpaw	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
54, 54B----- Regent	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Moderate: depth to rock.	Poor: area reclaim, too clayey.
54C----- Regent	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Moderate: depth to rock.	Poor: area reclaim, too clayey.
54D----- Regent	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim, too clayey.
55C----- Rhoades	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight-----	Poor: too clayey.
58, 58B----- Bowdle	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy, seepage.
60B----- Farland	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Fair: too clayey.
62, 62B----- Amor	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
62C----- Amor	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
62D----- Amor	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim.
63D----- Wabek	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
64----- Wilton	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Fair: too clayey.
64B----- Temvik	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Fair: too clayey.
64C----- Temvik	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
66C: Seroco	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
66E: Seroco	Severe: slope.	Severe: seepage, slope.	Severe: too sandy, seepage, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
67B: Vebar	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: area reclaim.
67C, 67D: Vebar	Severe: depth to rock.	Severe: seepage, slope.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: area reclaim.
70*, 70B*:					
Williams	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Bowbells	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
70C: Williams	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
72*, 72B*:					
Williams	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Reeder	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
72C*:					
Williams	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Reeder	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
73C*:					
Williams	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Zahl	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
73E*:					
Williams	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Zahl	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
79D*:					
Telfer	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
79D*:					
Flasher	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Poor: area reclaim.
79E*:					
Flasher	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: seepage, slope, depth to rock.	Poor: slope, area reclaim.
Telfer	Severe: slope.	Severe: seepage, slope.	Severe: too sandy, seepage, slope.	Severe: seepage, slope.	Poor: too sandy, seepage, slope.
82 Arveson	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness.	Poor: wetness.
84 Havrelon Variant	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Fair: wetness.
85 Hamerly	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
88 Lallie	Severe: wetness, floods, percs slowly.	Slight	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: wetness, too clayey.
93B Ekalaka	Severe: percs slowly.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: excess sodium, too sandy.
98 Banks Variant	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, seepage, wetness.	Poor: seepage.
162*:					
Omio	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
Grassna	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
162B*:					
Omio	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock,	Poor: area reclaim.
Amor	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
162C*:					
Omio	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
Amor	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
164*, 164B*:					
Williams	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Falkirk	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
3---------- Regan	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
6B---------- Niobell	Poor: low strength.	Unsuited: excess sodium.	Unsuited: excess sodium.	Poor: excess sodium.
8---------- Heil	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey, excess salt.
9---------- Tonka	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
10---------- Parnell	Poor: wetness, low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
11---------- Straw	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
12---------- Neche Variant	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
13, 13B---------- Arnegard	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
15D*:				
Cabba----------	Poor: thin layer, area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
Amor----------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, area reclaim.
15E*:				
Cabba----------	Poor: thin layer, low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim, slope.
Amor----------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
17*, 17B*, 17C*:				
Stady----------	Good----------	Good----------	Good----------	Fair: area reclaim.
Lehr----------	Good----------	Good----------	Good----------	Poor: area reclaim.
18B*, 18C*:				
Reeder----------	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
18B*, 18C*:				
Rhoades	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, excess sodium, excess salt.
19 Straw	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
21, 21B Shambo	Poor: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
22*, 22B*:				
Belfield	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Daglum	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess sodium.
23D*:				
Vebar	Poor: area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: slope, area reclaim.
Cohagen	Poor: thin layer, area reclaim.	Poor: thin layer, excess fines.	Unsuited: excess fines.	Fair: area reclaim, slope.
23E*:				
Vebar	Poor: area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: slope.
Cohagen	Poor: slope, thin layer, area reclaim.	Poor: thin layer, excess fines.	Unsuited: excess fines.	Poor: slope.
24, 24B Grassna	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
25B, 25C Flaxton	Poor: low strength.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Good.
25D Flaxton	Poor: low strength.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: slope.
26B, 26C Krem	Poor: low strength.	Poor: thin layer, excess fines.	Unsuited: excess fines.	Fair: too sandy.
28 Grail	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
29 Harriet	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, excess salt, excess sodium.
31 Parnell	Poor: wetness, low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
32B, 32C-------------- Lihen	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope, too sandy.
33B*, 33C*:				
Parshall--------------	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Lihen-----------------	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
35C------------------- Sutley	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
35E------------------- Sutley	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
36B, 36C-------------- Bryant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
40C*:				
Amor------------------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
Cabba-----------------	Poor: thin layer, area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
40D*:				
Amor------------------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, area reclaim.
Cabba-----------------	Poor: thin layer, area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
41, 41B, 41C---------- Reeder	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
41D------------------- Reeder	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, area reclaim.
43D------------------- Reeder	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
44*, 44C*:				
Daglum----------------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess sodium.
Rhoades---------------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, excess sodium, excess salt.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
46B*, 46C*:				
Regent	Poor: shrink-swell, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, area reclaim.
Daglum	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess sodium.
47B Manning	Good	Fair: excess fines.	Fair: excess fines.	Fair: area reclaim, small stones.
49B Telfer	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
51B Noonan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess sodium.
53, 53B, 53C Bearpaw	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
54, 54B, 54C Regent	Poor: shrink-swell, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, area reclaim.
54D Regent	Poor: shrink-swell, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope, area reclaim.
55C Rhoades	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, excess sodium, excess salt.
58, 58B Bowdle	Good	Fair: excess fines.	Poor: excess fines.	Good.
60B Farland	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
62, 62B, 62C Amor	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
62D Amor	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, area reclaim.
63D Wabek	Good	Good	Good	Poor: small stones, area reclaim.
64 Wilton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
64B, 64C Temvik	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
66C Seroco	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
66E Seroco	Fair: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
67B, 67C: Vebar	Poor: area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: area reclaim.
67D: Vebar	Poor: area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: slope, area reclaim.
70*, 70B*:				
Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bowbells	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
70C: Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
72*, 72B*, 72C*:				
Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Reeder	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
73C*:				
Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Zahl	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
73E*:				
Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Zahl	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
79D*:				
Telfer	Good.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Flasher	Poor: thin layer, area reclaim.	Poor: thin layer, excess fines.	Unsuited: excess fines.	Poor: area reclaim.
79E*:				
Flasher	Poor: slope, thin layer, area reclaim.	Poor: thin layer, excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
Telfer	Fair: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy, slope.
82: Arveson	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
84: Havrelon Variant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
85: Hamerly	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
88: Lallie	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, excess salt.
93B: Ekalaka	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: excess sodium.
98: Banks Variant	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
162*:				
Omio	Poor: area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, thin layer.
Grassna	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
162B*, 162C*:				
Omio	Poor: area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, thin layer.
Amor	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
164*, 164B*:				
Williams	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Falkirk	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
3 Regan	Seepage	Wetness	Floods, frost action.	Floods, wetness.	Wetness	Wetness.
6B Niobell	Slope	Piping	Not needed	Percs slowly, excess sodium, slope.	Percs slowly	Percs slowly.
8 Heil	Favorable	Hard to pack, piping.	Floods, percs slowly, excess salt.	Slow intake, percs slowly, floods.	Wetness, percs slowly.	Excess salt, excess sodium, wetness.
9 Tonka	Favorable	Hard to pack, wetness.	Frost action, percs slowly, floods.	Wetness, percs slowly, floods.	Not needed	Wetness, percs slowly, erodes easily.
10 Parnell	Favorable	Hard to pack, wetness.	Floods, percs slowly, frost action.	Wetness, slow intake, percs slowly.	Not needed	Wetness, percs slowly.
11 Straw	Seepage	Seepage	Favorable	Favorable	Favorable	Favorable.
12 Neche Variant	Favorable	Wetness, piping.	Floods, frost action.	Floods, wetness.	Not needed	Wetness.
13 Arnegard	Seepage	Piping	Not needed	Favorable	Favorable	Favorable.
13B Arnegard	Slope, seepage.	Piping	Not needed	Slope	Favorable	Favorable.
15D*, 15E*: Cabba	Depth to rock, seepage, slope.	Thin layer	Depth to rock, slope.	Depth to rock, slope, droughty.	Slope, depth to rock.	Slope, rooting depth, erodes easily.
Amor	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
17*: Stady	Seepage	Seepage	Not needed	Favorable	Too sandy	Favorable.
Lehr	Seepage	Seepage	Not needed	Droughty	Too sandy	Droughty.
17B*: Stady	Slope, seepage.	Seepage	Not needed	Slope	Too sandy	Favorable.
Lehr	Seepage	Seepage	Not needed	Droughty, slope.	Too sandy	Droughty.
17C*: Stady	Slope, seepage.	Seepage	Not needed	Slope	Too sandy	Favorable.
Lehr	Slope, seepage.	Seepage	Not needed	Droughty, slope.	Too sandy	Droughty.
18B*: Reeder		Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
Rhoades	Slope	Hard to pack, piping.	Not needed	Excess sodium, excess salt, percs slowly.	Percs slowly	Excess sodium, excess salt.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
18C*:						
Reeder	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
Rhoades	Slope	Hard to pack, piping.	Not needed	Excess sodium, excess salt, percs slowly.	Percs slowly	Excess sodium, excess salt.
19 Straw	Seepage	Seepage	Slope	Slope	Favorable	Favorable.
21 Shambo	Seepage	Piping	Not needed	Favorable	Favorable	Favorable.
21B Shambo	Slope, seepage.	Piping	Not needed	Slope	Favorable	Favorable.
22*:						
Belfield	Favorable	Hard to pack	Not needed	Percs slowly, excess sodium.	Percs slowly	Excess sodium, excess salt.
Daglum	Depth to rock	Hard to pack, piping.	Not needed	Percs slowly, excess sodium, excess salt.	Percs slowly	Excess sodium, excess salt.
22B*:						
Belfield	Slope	Hard to pack	Not needed	Percs slowly, slope, excess sodium.	Percs slowly	Excess sodium, excess salt.
Daglum	Depth to rock	Hard to pack, piping.	Not needed	Percs slowly, excess sodium, excess salt.	Percs slowly	Excess sodium, excess salt.
23D*, 23E*:						
Vebar	Slope, seepage, depth to rock.	Thin layer	Not needed	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Cohagen	Slope, seepage, depth to rock.	Piping, seepage.	Not needed	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, rooting depth, depth to rock.
24 Grassna	Seepage	Piping	Not needed	Favorable	Favorable	Favorable.
24B Grassna	Seepage, slope.	Piping	Not needed	Slope	Favorable	Favorable.
25B Flaxton	Seepage	Favorable	Not needed	Soil blowing	Soil blowing	Erodes easily.
25C Flaxton	Slope, seepage.	Favorable	Not needed	Slope, soil blowing.	Soil blowing	Erodes easily.
25D Flaxton	Slope, seepage.	Favorable	Not needed	Slope, soil blowing.	Slope, soil blowing.	Slope, erodes easily.
26B, 26C Krem	Slope, seepage.	Piping	Not needed	Fast intake, soil blowing, slope.	Too sandy, soil blowing.	Erodes easily.
28 Grail	Favorable	Compressible, low strength, piping.	Not needed	Slow intake	Piping	Favorable.
29 Harriet	Favorable	Wetness, piping.	Floods, percs slowly, frost action.	Wetness, percs slowly, excess sodium.	Not needed	Wetness, excess salt, excess sodium.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
31 Parnell	Favorable	Hard to pack, wetness.	Floods, percs slowly, frost action.	Wetness, slow intake, percs slowly.	Not needed	Wetness, percs slowly.
32B Lihen	Seepage	Piping	Slope	Slope, droughty, fast intake.	Soil blowing	Droughty.
32C Lihen	Seepage, slope.	Piping	Slope	Slope, droughty, fast intake.	Soil blowing	Slope, droughty.
33B*:						
Parshall	Slope, seepage.	Seepage, piping.	Not needed	Slope, soil blowing.	Soil blowing	Favorable.
Lihen	Seepage	Piping	Slope	Slope, droughty, fast intake.	Soil blowing	Droughty.
33C*:						
Parshall	Slope, seepage.	Seepage, piping.	Not needed	Slope, soil blowing.	Soil blowing	Favorable.
Lihen	Seepage, slope.	Piping	Slope	Slope, droughty, fast intake.	Soil blowing	Slope, droughty.
35C Sutley	Seepage, slope.	Piping	Not needed	Slope	Erodes easily	Erodes easily.
35E Sutley	Slope	Piping	Not needed	Slope	Erodes easily, slope.	Slope, erodes easily.
36B, 36C Bryant	Slope, seepage.	Piping	Not needed	Slope	Erodes easily	Erodes easily.
40C*:						
Amor	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
Cabba	Depth to rock, seepage, slope.	Thin layer	Depth to rock, slope.	Depth to rock, slope, droughty.	Depth to rock	Rooting depth, erodes easily.
40D*:						
Amor	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Cabba	Depth to rock, seepage, slope.	Thin layer	Depth to rock, slope.	Depth to rock, slope, droughty.	Slope, depth to rock.	Slope, rooting depth, erodes easily.
41 Reeder	Seepage, depth to rock.	Thin layer	Not needed	Depth to rock	Depth to rock	Depth to rock.
41B Reeder	Seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
41C Reeder	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
41D Reeder	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
43D----------------- Reeder	Slope, seepage, depth to rock.	Thin layer-----	Not needed-----	Depth to rock, slope.	Depth to rock	Slope, depth to rock.
44*:						
Daglum------------	Depth to rock	Hard to pack, piping.	Not needed-----	Percs slowly, excess sodium, excess salt.	Percs slowly---	Excess sodium, excess salt.
Rhoades-----------	Favorable------	Hard to pack, piping.	Not needed-----	Excess sodium, excess salt, percs slowly.	Percs slowly---	Excess sodium, excess salt.
44C*:						
Daglum------------	Slope, depth to rock.	Hard to pack, piping.	Not needed-----	Percs slowly, excess sodium, excess salt.	Percs slowly---	Excess sodium, excess salt.
Rhoades-----------	Slope----------	Hard to pack, piping.	Not needed-----	Excess sodium, excess salt, percs slowly.	Percs slowly---	Excess sodium, excess salt.
46B*:						
Regent------------	Slope, depth to rock.	Hard to pack, thin layer.	Not needed-----	Depth to rock, percs slowly, slope.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
Daglum------------	Depth to rock	Hard to pack, piping.	Not needed-----	Percs slowly, excess sodium, excess salt.	Percs slowly---	Excess sodium, excess salt.
46C*:						
Regent------------	Slope, depth to rock.	Hard to pack thin layer.	Not needed-----	Depth to rock, percs slowly, slope.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
Daglum------------	Slope, depth to rock.	Hard to pack, piping.	Not needed-----	Percs slowly, excess sodium, excess salt.	Percs slowly---	Excess sodium, excess salt.
47B----------------- Manning	Slope, seepage.	Seepage---------	Not needed-----	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
49B----------------- Telfer	Slope, seepage.	Piping----------	Not needed-----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
51B----------------- Noonan	Slope----------	Piping----------	Not needed-----	Percs slowly, slope, excess sodium.	Percs slowly---	Excess sodium, percs slowly.
53, 53B------------ Bearpaw	Favorable------	Hard to pack---	Percs slowly, slope.	Slope, percs slowly, erodes easily.	Percs slowly---	Percs slowly, erodes easily.
53C----------------- Bearpaw	Slope----------	Hard to pack---	Percs slowly, slope.	Slope, percs slowly, erodes easily.	Percs slowly---	Percs slowly, erodes easily.
54------------------ Regent	Depth to rock	Hard to pack, thin layer.	Not needed-----	Depth to rock, percs slowly.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
54B, 54C----------- Regent	Slope, depth to rock.	Hard to pack, thin layer.	Not needed-----	Depth to rock, percs slowly, slope.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
54D----------------- Regent	Slope, depth to rock.	Hard to pack, thin layer.	Not needed-----	Depth to rock, percs slowly, slope.	Slope, depth to rock.	Slope, depth to rock, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
55C Rhoades	Slope	Hard to pack, piping.	Not needed	Excess sodium, excess salt, percs slowly.	Percs slowly	Excess sodium, excess salt.
58 Bowdle	Seepage	Seepage, piping.	Not needed	Favorable	Too sandy	Favorable.
58B Bowdle	Seepage, slope.	Seepage, piping.	Not needed	Slope	Too sandy	Favorable.
60B Farland	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
62, 62B Amor	Seepage, depth to rock.	Thin layer	Not needed	Depth to rock	Depth to rock	Depth to rock.
62C Amor	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
62D Amor	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
63D Wabek	Slope, seepage.	Seepage	Not needed	Droughty, slope.	Slope, too sandy.	Slope, droughty.
64 Wilton	Favorable	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
64B, 64C Temvik	Slope	Piping	Not needed	Slope	Erodes easily	Erodes easily.
66C Seroco	Slope, seepage.	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
66E Seroco	Slope, seepage.	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
67B, 67C Vebar	Slope, seepage, depth to rock.	Thin layer	Not needed	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.	Depth to rock.
67D Vebar	Slope, seepage, depth to rock.	Thin layer	Not needed	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
70*:						
Williams	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Bowbells	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
70B*:						
Williams	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
Bowbells	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
70C Williams	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
72*:						
Williams	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Reeder	Seepage, depth to rock.	Thin layer	Not needed	Depth to rock	Depth to rock	Depth to rock.
72B*:						
Williams	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
72B*:						
Reeder	Seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
72C*:						
Williams	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
Reeder	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
73C*:						
Williams	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
Zahl	Slope	Favorable	Not needed	Percs slowly, slope.	Percs slowly, erodes easily.	Erodes easily, percs slowly.
73E*:						
Williams	Slope	Favorable	Not needed	Slope	Slope	Slope, erodes easily.
Zahl	Slope	Favorable	Not needed	Percs slowly, slope.	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
79D*:						
Telfer	Slope, seepage.	Piping	Not needed	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Flasher	Slope, depth to rock, seepage.	Thin layer, seepage.	Not needed	Droughty, depth to rock, slope.	Depth to rock, too sandy.	Slope, depth to rock, rooting depth.
79E*:						
Flasher	Slope, depth to rock, seepage.	Thin layer, seepage.	Not needed	Droughty, depth to rock, slope.	Slope, depth to rock, too sandy.	Slope, depth to rock, rooting depth.
Telfer	Slope, seepage.	Piping	Not needed	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
82 Arveson	Seepage	Seepage, wetness.	Frost action	Wetness	Not needed	Wetness.
84 Havrelon Variant	Seepage	Piping	Floods	Wetness, floods.	Wetness	Favorable.
85 Hamerly	Seepage	Wetness	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
88 Lallie	Favorable	Hard to pack, wetness, excess salt.	Floods, frost action, excess salt.	Wetness, percs slowly, excess salt.	Not needed	Wetness, percs slowly, excess salt.
93B Ekalaka	Slope, seepage.	Piping, excess salt.	Not needed	Soil blowing, droughty, slope.	Too sandy, soil blowing, percs slowly.	Excess salt, excess sodium.
98 Banks Variant	Seepage	Seepage, piping.	Deep to water	Droughty, floods.	Too sandy	Droughty.
162*:						
Omio	Seepage, depth to rock.	Piping	Not needed	Depth to rock	Depth to rock	Depth to rock.
Grassna	Seepage	Piping	Not needed	Favorable	Favorable	Favorable.
162B*:						
Omio	Seepage, depth to rock.	Piping	Not needed	Depth to rock	Depth to rock	Depth to rock.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
162B*:						
Amor	Seepage, depth to rock.	Thin layer	Not needed	Depth to rock	Depth to rock	Depth to rock.
162C*:						
Omio	Seepage, depth to rock, slope.	Piping	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
Amor	Slope, seepage, depth to rock.	Thin layer	Not needed	Depth to rock, slope.	Depth to rock	Depth to rock.
164*:						
Williams	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Falkirk	Favorable	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
164B*:						
Williams	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
Falkirk	Slope	Favorable	Not needed	Slope	Erodes easily	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
3 Regan	0-60	Silt loam, loam	CL, CL-ML	A-7, A-6, A-4	0	100	100	90-100	80-95	20-50	5-30
6B Niobell	0-10	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	3-18
	10-23	Clay loam, loam	CL, CH	A-6, A-7	0-1	95-100	95-100	90-100	70-80	30-60	15-35
	23-60	Loam, clay loam	ML, CL, CL-ML	A-4, A-6	0-1	95-100	95-100	85-95	60-75	25-40	3-18
8 Heil	0-3	Silt loam	CL	A-6, A-7	0	100	100	90-100	70-95	25-50	10-25
	3-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	90-100	75-95	50-70	25-45
9 Tonka	0-18	Silt loam	CL, CL-ML	A-4, A-6	0-2	100	95-100	90-100	70-90	20-40	5-25
	18-39	Silty clay loam, clay loam, clay.	CH, CL	A-6, A-7	0-2	100	95-100	90-100	75-95	35-55	15-35
	39-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-3	100	95-100	90-100	70-90	20-50	10-30
10 Parnell	0-9	Silt loam	OL, ML	A-4	0	100	100	90-100	70-90	25-40	2-10
	9-39	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-80	20-50
	39-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-95	70-95	30-80	15-50
11 Straw	0-60	Silt loam	CL-ML, CL	A-4	0	100	100	85-100	60-90	20-30	5-10
12 Neche Variant	0-7	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-75	25-40	3-15
	7-60	Loam, silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	25-40	3-15
13, 13B Arnegard	0-15	Loam	CL-ML, CL	A-4, A-6	0	100	100	85-100	60-90	20-35	5-20
	15-32	Loam, silt loam, clay loam.	CL	A-6	0	100	100	85-100	50-90	25-40	12-25
	32-60	Loam, clay loam, loamy fine sand.	SM, ML, CL, SC	A-4, A-6	0	100	100	70-100	40-80	15-40	NP-15
15D*, 15E*: Cabba	0-10	Loam	SM-SC, CL-ML, SC, CL	A-6, A-4	0	100	100	95-100	45-70	20-35	5-15
	10-17	Loam, silt loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-50	10-25
	17-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Amor	0-6	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	25-40	3-18
	6-29	Clay loam, loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	75-100	50-80	20-45	2-25
	29-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17*, 17B*, 17C*:											
Stady	0-7	Loam	ML, CL	A-4, A-6	0-1	95-100	95-100	85-95	60-75	25-40	3-15
	7-22	Loam	ML, CL	A-4, A-6	0-1	95-100	95-100	85-95	60-75	25-40	3-15
	22-26	Loam, gravelly loam.	ML, CL	A-4, A-6	0-1	80-100	80-100	75-95	55-75	25-40	3-15
	26-60	Sand and gravel	SM, SP, GM, GP	A-1	0-1	50-100	50-95	10-30	2-15	---	NP
Lehr	0-6	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-80	20-40	3-15
	6-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	85-95	60-75	25-40	5-15
	15-19	Gravelly coarse sandy loam, gravelly loamy sand.	SM, SP-SM	A-1	0-5	65-90	50-75	30-50	5-15	---	NP
	19-60	Sand and gravel	SM, SP, GM, GP	A-1	0-5	40-70	25-50	10-35	2-15	---	NP
18B*, 18C*:											
Reeder	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	20-40	5-20
	6-25	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	60-80	25-50	5-30
	25-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Rhoades	0-4	Silt loam	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	10-25
	4-24	Clay loam, silty clay, clay.	CL, CH	A-7	0	100	100	90-100	80-95	40-75	20-45
	24-48	Silty clay, clay loam, loam.	CL, CH	A-6, A-7	0	100	100	85-100	75-95	35-70	20-40
	48-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
19 Straw	0-60	Silt loam	CL-ML, CL	A-4	0	100	100	85-100	60-90	20-30	5-10
21, 21B Shambo	0-5	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-35	3-13
	5-20	Loam, silt loam, clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-40	3-18
	20-60	Stratified loam to silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-40	3-18
22*, 22B*:											
Belfield	0-14	Silt loam	CL	A-4, A-6	0	100	100	85-100	60-90	20-40	10-25
	14-43	Silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	100	100	90-100	70-95	40-65	15-40
	43-60	Silty clay, silty clay loam, loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-95	30-55	10-30
Daglum	0-7	Silt loam	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	15-25
	7-27	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-75	15-45
	27-46	Clay, silty clay, silty clay loam.	CL	A-7	0	100	100	90-100	65-95	40-50	20-30
	46-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
23D*, 23E*:											
Vebar----------------	0-23	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	23-30	Fine sandy loam, loamy fine sand, sandy loam.	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	30-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Cohagen------------	0-16	Fine sandy loam	SM	A-2, A-4	0	100	95-100	60-85	30-50	---	NP
	16-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
24, 24B------------- Grassna	0-17	Silt loam-------	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-90	20-45	3-25
	17-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-95	25-45	3-25
25B, 25C, 25D------ Flaxton	0-26	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	40-55	<30	NP-5
	26-38	Fine sandy loam, loamy fine sand.	SM	A-2, A-4	0	100	100	60-85	30-45	<30	NP-5
	38-60	Clay loam, loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-80	25-45	5-25
26B, 26C------------ Krem	0-27	Loamy fine sand	SM	A-2	0-1	95-100	95-100	50-75	15-30	---	NP
	27-60	Clay loam, loam, sandy clay loam.	CL, ML, CL-ML	A-6, A-7, A-4	0-5	95-100	95-100	85-95	60-80	25-50	3-28
28------------------ Grail	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	20-45	10-30
	7-34	Silty clay------	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	34-60	Loam, silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-95	20-50	3-30
29------------------ Harriet	0-3	Silt loam-------	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-90	25-45	5-20
	3-18	Clay loam, silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-70	15-50
	18-60	Very fine sandy loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-95	55-80	20-45	5-25
31------------------ Parnell	0-9	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-95	40-60	15-30
	9-39	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-80	20-50
	39-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-95	70-95	30-80	15-50
32B, 32C------------ Lihen	0-23	Loamy fine sand	SM	A-2	0	100	85-100	45-75	15-30	---	NP
	23-60	Loamy fine sand, loamy sand, fine sand.	SM	A-2	0	100	85-100	45-75	15-35	---	NP
33B*, 33C*:											
Parshall-----------	0-21	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	21-60	Fine sandy loam, loam, loamy sand.	SM, ML	A-4, A-2	0	100	100	60-100	30-55	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
33B*, 33C*:											
Lihen	0-23	Fine sandy loam	SM	A-2, A-4	0	100	85-100	60-80	35-50	---	NP
	23-60	Loamy fine sand, loamy sand, fine sand.	SM	A-2	0	100	85-100	45-75	15-35	---	NP
35C, 35E Sutley	0-5	Silt loam	ML, CL-ML	A-4	0	100	100	90-100	70-100	25-35	5-10
	5-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	90-100	70-100	20-35	NP-8
36B, 36C Bryant	0-8	Silt loam	ML, CL, CL-ML	A-6, A-4	0	100	100	85-100	70-100	20-40	5-22
	8-22	Clay loam, silt loam, silty clay loam.	CL, ML	A-6, A-4	0	100	100	85-100	70-100	25-40	7-20
	22-60	Clay loam, loam, silt loam.	CL, ML	A-6, A-4	0	100	100	85-100	70-100	25-40	7-20
40C*, 40D*:											
Amor	0-6	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	25-40	3-18
	6-29	Clay loam, loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	75-100	50-80	20-45	2-25
	29-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Cabba	0-10	Loam	SM-SC, CL-ML, SC, CL	A-6, A-4	0	100	100	95-100	45-70	20-35	5-15
	10-17	Loam, silt loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-50	10-25
	17-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
41, 41B, 41C, 41D Reeder	0-6	Loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	20-40	5-20
	6-25	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	60-80	25-50	5-30
	25-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
43D Reeder	0-6	Loam	CL, CL-ML	A-4, A-6	1-20	100	100	90-100	65-85	20-40	5-20
	6-25	Clay loam, loam	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	60-80	25-50	5-30
	25-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
44*, 44C*:											
Daglum	0-7	Silt loam	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	15-25
	7-27	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-75	15-45
	27-46	Clay, silty clay, silty clay loam.	CL	A-7	0	100	100	90-100	65-95	40-50	20-30
	46-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Rhoades	0-4	Silt loam	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	10-25
	4-24	Clay loam, silty clay, clay.	CL, CH	A-7	0	100	100	90-100	80-95	40-75	20-45
	24-48	Silty clay, clay loam, loam.	CL, CH	A-6, A-7	0	100	100	85-100	75-95	35-70	20-40
	48-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
46B*, 46C*:											
Regent	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-95	30-50	15-30
	7-31	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	90-100	80-95	40-70	15-45
	31-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Daglum	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	15-25
	7-27	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-75	15-45
	27-46	Clay, silty clay, silty clay loam.	CL	A-7	0	100	100	90-100	65-95	40-50	20-30
	46-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
47B Manning	0-7	Fine sandy loam	SM	A-2, A-4	0	95-100	95-100	60-85	30-50	---	NP
	7-28	Sandy loam, fine sandy loam, loam.	SM, ML, CL, SC	A-2, A-4, A-6	0-3	85-100	80-100	60-95	30-70	<35	NP-15
	28-60	Sand and gravel	GM, SM, GP-GM, SP-SM	A-1, A-2	0-5	25-75	15-65	10-40	5-35	---	NP
49B Telfer	0-15	Loamy fine sand	SM	A-2	0	100	100	50-80	15-35	---	NP
	15-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	100	50-80	15-35	---	NP
51B Noonan	0-9	Loam	CL, CL-ML	A-4, A-6	0-1	95-100	95-100	80-95	55-75	20-40	5-25
	9-16	Clay loam	CL, CH	A-6, A-7	0-1	95-100	95-100	85-95	65-80	25-60	10-35
	16-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-1	95-100	95-100	80-95	60-80	25-50	5-25
53, 53B, 53C Bearpaw	0-3	Silt loam	ML	A-4	0-5	100	100	90-100	70-90	25-40	NP-10
	3-27	Clay loam, clay	CL, CH	A-7	0-5	95-100	95-100	90-100	70-85	45-55	20-30
	27-60	Clay loam	CL	A-6, A-7	0-5	95-100	95-100	90-100	70-80	25-45	10-20
54 Regent	0-9	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-95	30-50	15-30
	9-39	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	90-100	80-95	40-70	15-45
	39-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
54B, 54C, 54D Regent	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-95	30-50	15-30
	6-31	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	90-100	80-95	40-70	15-45
	31-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
55C Rhoades	0-4	Silt loam	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	10-25
	4-24	Clay loam, silty clay, clay.	CL, CH	A-7	0	100	100	90-100	80-95	40-75	20-45
	24-48	Silty clay, silty clay loam, loam.	CL, CH	A-6, A-7	0	100	100	85-100	75-95	35-70	20-40
	48-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
58, 58B Bowdle	0-19	Loam	ML, CL	A-6, A-4	0	100	95-100	85-95	55-80	30-40	8-15
	19-32	Loam, clay loam	CL, CL	A-4, A-6	0	95-100	95-100	80-95	55-75	30-40	8-15
	32-60	Sand and gravel	SM, SW-SM	A-1, A-2	0-5	60-95	50-85	25-50	5-30	<30	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
60B: Farland	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	85-100	70-90	20-40	5-25
	6-15	Silty clay loam, clay loam.	CL, CH	A-7	0	100	100	90-100	75-95	40-60	15-35
	15-60	Loam, clay loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	85-100	70-90	25-50	5-30
62, 62B, 62C, 62D: Amor	0-6	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	25-40	3-18
	6-29	Clay loam, loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	75-100	50-80	20-45	2-25
	29-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
63D: Wabek	0-6	Loam	ML	A-4	0-1	90-100	90-100	75-90	50-70	25-40	NP-10
	6-9	Gravelly sandy loam, gravelly loam, gravelly coarse sandy loam.	SM, GM	A-2, A-4	0-1	50-100	50-95	50-65	20-40	---	NP
	9-60	Very gravelly coarse sand, gravelly loamy coarse sand, sand.	SM, SP, GM, GP	A-1, A-2	0-1	50-100	50-95	10-40	2-35	---	NP
64: Wilton	0-23	Silt loam	CL-ML, CL	A-4	0	100	100	90-100	70-90	25-35	5-15
	23-60	Loam, clay loam	ML, CL	A-4, A-6, A-7	0-5	90-100	85-100	80-95	60-80	30-50	5-25
64B, 64C: Temvik	0-7	Silt loam	ML	A-4	0	100	100	90-100	70-90	25-40	2-10
	7-24	Silt loam, silty clay loam, clay loam.	CL	A-6	0	100	100	90-100	70-90	25-40	10-19
	24-60	Clay loam, loam	CL	A-6	0-5	95-100	95-100	80-100	55-80	25-40	10-19
66C, 66E: Seroco	0-4	Fine sand	SM	A-2	0	100	100	65-80	20-35	---	NP
	4-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	100	65-80	20-35	---	NP
67B: Vebar	0-23	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	23-30	Fine sandy loam, loamy fine sand, sandy loam.	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	30-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
67C, 67D: Vebar	0-23	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	23-30	Fine sandy loam, loamy fine sand, sandy loam.	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	30-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
70*, 70B*: Williams	0-5	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	5-14	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	14-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	95-100	60-80	30-50	10-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
70*, 70B*:											
Bowbells	0-7	Loam	CL, ML, CL-ML	A-4, A-6	0-5	95-100	90-100	85-95	60-90	20-40	3-23
	7-38	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	20-45	10-25
	38-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	20-45	10-25
70C: Williams	0-5	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	5-14	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	14-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	95-100	60-80	30-50	10-30
72*, 72B*:											
Williams	0-5	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	5-14	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	14-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	95-100	60-80	30-50	10-30
Reeder	0-6	Loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	20-40	5-20
	6-34	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	60-80	25-50	5-30
	34-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
72C*:											
Williams	0-5	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	5-14	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	14-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	95-100	60-80	30-50	10-30
Reeder	0-6	Loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	20-40	5-20
	6-25	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	60-80	25-50	5-30
	25-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
73C*, 73E*:											
Williams	0-5	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	5-14	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	14-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	95-100	60-80	30-50	10-30
Zahl	0-6	Loam	CL	A-6	0-1	95-100	95-100	80-95	55-75	25-40	10-20
	6-60	Clay loam, loam	CL	A-6	0-1	95-100	90-100	80-95	60-80	25-40	10-20
79D*:											
Telfer	0-15	Loamy fine sand	SM	A-2	0	100	100	50-80	15-35	---	NP
	15-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	100	50-80	15-35	---	NP
Flasher	0-5	Loamy fine sand	SM	A-2	0-5	100	95-100	50-80	15-35	---	NP
	5-14	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0-5	100	95-100	50-80	15-35	---	NP
	14-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
79E*:											
Flasher-----------	0-5	Loamy fine sand	SM	A-2	0-5	100	95-100	50-80	15-35	---	NP
	5-14	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0-5	100	95-100	50-80	15-35	---	NP
	14-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Telfer------------	0-15	Loamy fine sand	SM	A-2	0	100	100	50-80	15-35	---	NP
	15-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	100	50-80	15-35	---	NP
82---------------- Arveson	0-14	Loam------------	OL, ML	A-4	0	100	95-100	85-90	50-65	20-40	NP-10
	14-26	Fine sandy loam, sandy loam, loam.	SM, SM-SC	A-4	0	100	95-100	60-85	35-50	<20	NP-5
	26-47	Fine sand, loamy sand, sandy loam.	SP-SM, SM, SM-SC	A-3, A-2, A-4	0	100	95-100	50-80	5-45	<20	NP-5
	47-60	Silty clay------	CL, CH	A-6, A-7	0	100	100	85-100	75-95	35-70	20-40
84---------------- Havrelon Variant	0-21	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-95	20-40	3-15
	21-60	Stratified silty clay loam to very fine sandy loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-80	25-45	10-28
85---------------- Hamerly	0-8	Loam------------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-95	60-90	20-40	5-25
	8-13	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-75	20-45	5-25
	13-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-75	20-45	5-25
88---------------- Lallie	0-8	Silt loam-------	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-90	20-45	3-25
	8-60	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-50
93B--------------- Ekalaka	0-16	Fine sandy loam	SM, ML	A-2, A-4	0	100	100	70-85	30-60	20-35	NP-10
	16-29	Fine sandy loam, loam, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	70-90	30-70	20-35	NP-10
	29-60	Sandy loam, loamy fine sand, fine sand.	SM	A-2, A-4	0	100	100	50-75	30-40	20-35	NP-10
98---------------- Banks Variant	0-7	Very fine sandy loam.	SM, ML	A-4	0	100	100	80-95	45-75	20-40	NP-10
	7-60	Loamy very fine sand, fine sand, fine sandy loam.	SM, SP-SM	A-2	0	100	100	50-70	10-25	---	NP
162*:											
Omio--------------	0-12	Silt loam-------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	20-40	10-20
	12-38	Silt loam, loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-95	40-75	15-30	NP-10
	38-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
162*:											
Grassna	0-18	Silt loam	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-90	20-45	3-25
	18-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-95	25-45	3-25
162B*, 162C*:											
Omio	0-12	Silt loam	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	20-40	10-20
	12-38	Silt loam, loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-95	40-75	15-30	NP-10
	38-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Amor	0-6	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	25-40	3-18
	6-29	Clay loam, loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	75-100	50-80	20-45	2-25
	29-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
164*, 164B*:											
Williams	0-5	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	5-14	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	14-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	95-100	60-80	30-50	10-30
Falkirk	0-7	Loam	ML	A-4	0	100	100	85-95	60-75	20-40	NP-10
	7-22	Loam	ML	A-4	0	100	100	85-95	60-75	20-40	NP-10
	22-31	Gravelly loam, loamy fine sand.	ML, SM, GM	A-4	0-5	65-95	65-90	55-80	40-70	20-40	NP-10
	31-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	85-100	80-95	60-80	25-50	5-30

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
3----------------- Regan	0-60	0.2-2.0	0.16-0.22	7.4-8.4	<4	Moderate	0.32	5	4L
6B----------------- Niobell	0-10	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.32	3	6
	10-23	0.06-0.2	0.15-0.19	7.4-8.4	<2	High-------	0.32		
	23-60	0.2-0.6	0.15-0.19	7.9-9.0	2-8	Moderate	0.32		
8----------------- Heil	0-3	<0.06	0.15-0.24	5.6-7.3	<2	Moderate	0.28	3	7
	3-60	<0.06	0.13-0.18	6.6-9.0	4-16	High-------	0.28		
9----------------- Tonka	0-18	0.6-2.0	0.18-0.23	5.6-7.3	<2	Low--------	0.32	5	6
	18-39	0.06-0.2	0.14-0.19	5.6-7.3	<2	High-------	0.43		
	39-60	0.2-0.6	0.14-0.19	6.6-9.0	<2	Moderate	0.43		
10---------------- Parnell	0-9	0.6-2.0	0.22-0.24	6.1-7.8	<2	Low--------	0.28	5	6
	9-39	0.06-0.2	0.13-0.19	6.6-7.8	<2	High-------	0.28		
	39-60	0.06-0.2	0.11-0.19	6.6-8.4	<2	High-------	0.28		
11---------------- Straw	0-60	0.6-2.0	0.16-0.18	6.6-8.4	<2	Low--------	0.32	5	5
12---------------- Neche Variant	0-7	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low--------	0.32	5	6
	7-60	0.6-2.0	0.17-0.22	6.1-7.8	<2	Low--------	0.32		
13, 13B----------- Arnegard	0-15	0.6-2.0	0.20-0.24	6.1-7.3	<2	Moderate	0.28	5	6
	15-32	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.28		
	32-60	0.6-2.0	0.14-0.18	6.6-8.4	<2	Low--------	0.28		
15D*, 15E*:									
Cabba------------	0-10	0.06-2.0	0.16-0.24	6.6-7.8	<4	Low--------	0.37	4	6
	10-17	0.06-2.0	0.15-0.22	7.9-8.4	2-8	Moderate	0.37		
	17-60	---	---	---	---	-----------	----		
Amor-------------	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-29	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	29-60	---	---	---	---	-----------	----		
17*, 17B*, 17C*:									
Stady------------	0-7	0.6-2.0	0.20-0.22	6.6-7.3	<2	Low--------	0.28	4	6
	7-22	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low--------	0.28		
	22-26	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.28		
	26-60	>20.0	0.02-0.04	7.4-8.4	<2	Low--------	0.10		
Lehr-------------	0-6	2.0-6.0	0.17-0.22	6.6-7.3	<2	Low--------	0.28	3	5
	6-15	2.0-6.0	0.17-0.20	6.6-7.8	<2	Moderate	0.28		
	15-19	6.0-20	0.09-0.11	7.4-8.4	<2	Low--------	0.10		
	19-60	>6.0	0.02-0.04	7.4-8.4	<2	Low--------	0.10		
18B*, 18C*:									
Reeder-----------	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-25	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	25-60	---	---	---	---	-----------	----		
Rhoades----------	0-4	0.6-2.0	0.15-0.17	5.6-7.3	<2	Moderate	0.32	3	6
	4-24	<0.2	0.10-0.12	>7.4	2-16	High-------	0.32		
	24-48	<0.2	0.10-0.12	>7.9	8-16	High-------	0.32		
	48-60	---	---	---	---	-----------	----		
19---------------- Straw	0-60	0.6-2.0	0.16-0.18	6.6-8.4	<2	Low--------	0.32	5	5

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
21, 21B----------- Shambo	0-5	0.6-2.0	0.20-0.22	6.6-7.3	<2	Low--------	0.28	5	6
	5-20	0.6-2.0	0.17-0.19	6.6-8.4	<2	Moderate	0.28		
	20-60	0.6-2.0	0.17-0.19	7.4-9.0	<2	Moderate	0.28		
22*, 22B*:									
Belfield---------	0-14	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.32	5	6
	14-43	0.06-0.2	0.14-0.18	6.6-7.8	<2	High-------	0.32		
	43-60	0.06-0.2	0.13-0.16	7.9-9.0	4-16	High-------	0.32		
Daglum-----------	0-7	0.6-2.0	0.16-0.18	6.1-7.3	<2	Moderate	0.32	3	6
	7-27	<0.2	0.12-0.14	6.6-9.0	2-8	High-------	0.32		
	27-46	<0.2	0.12-0.14	7.9-9.0	8-16	High-------	0.32		
	46-60	---	---	---	---	-----------	----		
23D*, 23E*:									
Vebar------------	0-23	2.0-6.0	0.15-0.17	6.1-7.8	<2	Low--------	0.20	4	3
	23-30	2.0-6.0	0.15-0.17	6.1-8.4	<2	Low--------	0.20		
	30-60	---	---	---	---	-----------	----		
Cohagen----------	0-16	0.6-6.0	0.13-0.18	7.4-8.4	<2	Low--------	0.24	2	3
	16-60	---	---	---	---	-----------	----		
24, 24B----------- Grassna	0-17	0.6-2.0	0.22-0.24	6.1-7.3	<2	Moderate	0.32	5	6
	17-60	0.6-2.0	0.16-0.22	6.6-8.4	<2	Moderate	0.32		
25B, 25C, 25D---- Flaxton	0-26	2.0-6.0	0.16-0.18	6.6-7.3	<2	Low--------	0.20	5	3
	26-38	2.0-6.0	0.15-0.17	6.6-7.3	<2	Low--------	0.20		
	38-60	0.2-0.6	0.14-0.19	7.4-8.4	<2	Moderate	0.37		
26B, 26C---------- Krem	0-27	6.0-20	0.09-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	27-60	0.2-0.6	0.15-0.19	6.1-8.4	<2	Moderate	0.37		
28---------------- Grail	0-7	0.2-0.6	0.18-0.23	6.6-7.3	<2	Moderate	0.32	5	7
	7-34	0.2-0.6	0.14-0.17	6.6-7.8	<2	High-------	0.32		
	34-60	0.2-0.6	0.13-0.22	7.4-8.4	<2	Moderate	0.32		
29---------------- Harriet	0-3	0.06-0.2	0.20-0.24	6.6-8.4	<2	Moderate	0.37	3	6
	3-18	0.06-0.2	0.15-0.23	7.4-9.0	4-16	High-------	0.37		
	18-60	0.06-0.2	0.14-0.18	8.5-9.0	4-16	Moderate	0.37		
31---------------- Parnell	0-9	0.2-0.6	0.18-0.22	6.1-7.8	<2	Moderate	0.28	5	7
	9-39	0.06-0.2	0.13-0.19	6.6-7.8	<2	High-------	0.28		
	39-60	0.06-0.2	0.11-0.19	6.6-8.4	<2	High-------	0.28		
32B, 32C---------- Lihen	0-23	6.0-20	0.06-0.12	6.6-7.8	<2	Low--------	0.17	5	2
	23-60	6.0-20	0.08-0.14	7.4-8.4	<2	Low--------	0.17		
33B*, 33C*:									
Parshall---------	0-21	2.0-6.0	0.16-0.18	6.6-7.3	<2	Low--------	0.20	5	3
	21-60	2.0-6.0	0.12-0.17	6.6-8.4	<2	Low--------	0.20		
Lihen------------	0-23	6.0-20	0.06-0.12	6.6-7.8	<2	Low--------	0.17	5	2
	23-60	6.0-20	0.08-0.14	7.4-8.4	<2	Low--------	0.17		
35C, 35E---------- Sutley	0-5	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low--------	0.32	5	4L
	5-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low--------	0.43		
36B, 36C---------- Bryant	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.32	5	6
	8-22	0.6-2.0	0.19-0.22	6.6-7.8	<2	Moderate	0.43		
	22-60	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43		
40C*, 40D*:									
Amor-------------	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-29	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	29-60	---	---	---	---	-----------	----		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
40C*, 40D*:									
Cabba-----------	0-10	0.06-2.0	0.16-0.24	6.6-7.8	<4	Low--------	0.37	4	6
	10-17	0.06-2.0	0.15-0.22	7.9-8.4	2-8	Moderate	0.37		
	17-60	---	---	---	---	----------	----		
41, 41B, 41C, 41D------------ Reeder	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-25	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	25-60	---	---	---	---	----------	----		
43D-------------- Reeder	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-25	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	25-60	---	---	---	---	----------	----		
44*, 44C*:									
Daglum----------	0-7	0.6-2.0	0.16-0.18	6.1-7.3	<2	Moderate	0.32	3	6
	7-27	<0.2	0.12-0.14	6.6-9.0	2-8	High------	0.32		
	27-46	<0.2	0.12-0.14	7.9-9.0	8-16	High------	0.32		
	46-60	---	---	---	---	----------	----		
Rhoades---------	0-4	0.6-2.0	0.15-0.17	5.6-7.3	<2	Moderate	0.32	3	6
	4-24	<0.2	0.10-0.12	>7.4	2-16	High------	0.32		
	24-48	<0.2	0.10-0.12	>7.9	8-16	High------	0.32		
	48-60	---	---	---	---	----------	----		
46B*, 46C*:									
Regent----------	0-7	0.06-0.2	0.17-0.20	6.1-7.3	<2	High------	0.32	4	7
	7-31	0.06-0.2	0.17-0.20	7.4-9.0	<8	High------	0.32		
	31-60	---	---	---	---	----------	----		
Daglum----------	0-7	0.6-2.0	0.16-0.18	6.1-7.3	<2	Moderate	0.32	3	6
	7-27	<0.2	0.12-0.14	6.6-9.0	2-8	High------	0.32		
	27-46	<0.2	0.12-0.14	7.9-9.0	8-16	High------	0.32		
	46-60	---	---	---	---	----------	----		
47B-------------- Manning	0-7	2.0-6.0	0.13-0.18	6.6-7.3	<2	Low--------	0.20	4	3
	7-28	2.0-6.0	0.12-0.20	6.6-8.4	<2	Low--------	0.20		
	28-60	>20	0.02-0.08	7.4-8.4	<2	Low--------	0.10		
49B-------------- Telfer	0-15	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	15-60	6.0-20	0.06-0.10	6.6-7.8	<2	Low--------	0.17		
51B-------------- Noonan	0-9	0.6-2.0	0.20-0.22	6.6-6.1	<2	Moderate	0.32	3	6
	9-16	0.06-0.2	0.12-0.14	7.4-6.6	<2	High------	0.32		
	16-60	0.06-0.2	0.10-0.14	7.9-9.0	2-8	Moderate	0.32		
53, 53B, 53C----- Bearpaw	0-3	0.2-0.6	0.16-0.20	6.1-7.8	<2	Low--------	0.37	5	5
	3-27	<0.2	0.15-0.18	6.6-8.4	<2	High------	0.43		
	27-60	<0.2	0.15-0.18	7.4-8.4	2-4	Moderate	0.43		
54--------------- Regent	0-9	0.06-0.2	0.17-0.20	6.1-7.3	<2	High------	0.32	4	7
	9-39	0.06-0.2	0.17-0.20	7.4-9.0	<8	High------	0.32		
	39-60	---	---	---	---	----------	----		
54B, 54C, 54D---- Regent	0-6	0.06-0.2	0.17-0.20	6.1-7.3	<2	High------	0.32	4	7
	6-31	0.06-0.2	0.17-0.20	7.4-9.0	<8	High------	0.32		
	31-60	---	---	---	---	----------	----		
55C-------------- Rhoades	0-4	0.6-2.0	0.15-0.17	5.6-7.3	<2	Moderate	0.32	3	6
	4-24	<0.2	0.10-0.12	>7.4	2-16	High------	0.32		
	24-48	<0.2	0.10-0.12	>7.9	8-16	High------	0.32		
	48-60	---	---	---	---	----------	----		
58, 58B---------- Bowdle	0-19	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low--------	0.28	4	6
	19-32	0.6-2.0	0.18-0.20	6.1-7.8	<2	Low--------	0.28		
	32-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low--------	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
60B--------------- Farland	0-6	0.6-2.0	0.19-0.21	6.1-7.3	<2	Low--------	0.32	5	6
	6-15	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.32		
	15-60	0.2-0.6	0.17-0.20	6.6-8.4	<4	Moderate	0.32		
62, 62B, 62C, 62D------------- Amor	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-29	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	29-60	---	---	---	---	-----------	----		
63D--------------- Wabek	0-6	2.0-6.0	0.20-0.22	6.6-7.8	<2	Low--------	0.28	2	5
	6-9	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low--------	0.10		
	9-60	>20	0.02-0.04	7.4-7.8	<2	Low--------	0.10		
64---------------- Wilton	0-23	0.6-2.0	0.22-0.24	6.1-7.3	<2	Low--------	0.28	5	6
	23-60	0.2-0.6	0.15-0.19	7.4-8.4	<2	Moderate	0.37		
64B, 64C---------- Temvik	0-7	0.6-2.0	0.22-0.24	6.6-7.3	<2	Low--------	0.32	5	6
	7-24	0.6-2.0	0.20-0.22	6.6-7.8	<2	Low--------	0.43		
	24-60	0.2-0.6	0.15-0.19	7.4-8.4	<2	Moderate	0.43		
66C, 66E---------- Seroco	0-4	6.0-20	0.07-0.09	6.1-7.3	<2	Low--------	0.15	5	1
	4-60	6.0-20	0.06-0.08	6.6-7.8	<2	Low--------	0.15		
67B--------------- Vebar	0-23	2.0-6.0	0.15-0.17	6.1-7.8	<2	Low--------	0.20	4	3
	23-30	2.0-6.0	0.15-0.17	6.1-8.4	<2	Low--------	0.20		
	30-60	---	---	---	---	-----------	----		
67C, 67D---------- Vebar	0-23	2.0-6.0	0.15-0.17	6.1-7.8	<2	Low--------	0.20	4	3
	23-30	2.0-6.0	0.15-0.17	6.1-8.4	<2	Low--------	0.20		
	30-60	---	---	---	---	-----------	----		
70*, 70B*: Williams---------	0-5	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low--------	0.28	5	6
	5-14	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.28		
	14-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		
Bowbells---------	0-7	0.6-2.0	0.17-0.24	6.1-7.3	<2	Low--------	0.28	5	6
	7-38	0.6-2.0	0.16-0.22	6.1-7.8	<2	Moderate	0.28		
	38-60	0.06-0.6	0.14-0.18	7.9-8.4	<2	Moderate	0.37		
70C--------------- Williams	0-5	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low--------	0.28	5	6
	5-14	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.28		
	14-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		
72*, 72B*: Williams---------	0-5	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low--------	0.28	5	6
	5-14	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.28		
	14-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		
Reeder-----------	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-34	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	34-60	---	---	---	---	-----------	----		
72C*: Williams---------	0-5	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low--------	0.28	5	6
	5-14	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.28		
	14-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		
Reeder-----------	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-25	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	25-60	---	---	---	---	-----------	----		
73C*, 73E*: Williams---------	0-5	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low--------	0.28	5	6
	5-14	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.28		
	14-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
73C*, 73E*:									
Zahl-------------	0-6	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	0.28	5	4L
	6-60	0.06-0.6	0.15-0.19	7.4-8.4	<2	Moderate	0.37		
79D*:									
Telfer-----------	0-15	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	15-60	6.0-20	0.06-0.10	6.6-7.8	<2	Low--------	0.17		
Flasher----------	0-5	6.0-20.0	0.08-0.12	6.6-8.4	<2	Low--------	0.17	2	2
	5-14	6.0-20.0	0.08-0.12	6.6-8.4	<2	Low--------	0.17		
	14-60	---	---	---	---	-----------	----		
79E*:									
Flasher----------	0-5	6.0-20.0	0.08-0.12	6.6-8.4	<2	Low--------	0.17	2	2
	5-14	6.0-20.0	0.08-0.12	6.6-8.4	<2	Low--------	0.17		
	14-60	---	---	---	---	-----------	----		
Telfer-----------	0-15	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	15-60	6.0-20	0.06-0.10	6.6-7.8	<2	Low--------	0.17		
82---------------- Arveson	0-14	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low--------	0.24	2	4L
	14-26	0.6-6.0	0.15-0.17	7.9-8.4	<2	Low--------	0.24		
	26-47	2.0-20	0.05-0.15	7.4-8.4	<2	Low--------	0.24		
	47-60	0.06-0.2	0.13-0.23	7.4-8.4	<2	High-------	0.24		
84---------------- Havrelon Variant	0-21	0.6-2.0	0.20-0.24	6.6-8.4	<2	Moderate	0.32	5	4L
	21-60	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.32		
85---------------- Hamerly	0-8	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.28	5	4L
	8-13	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28		
	13-60	0.2-2.0	0.14-0.19	7.4-8.4	<2	Moderate	0.37		
88---------------- Lallie	0-8	0.06-0.2	0.17-0.24	7.4-9.0	<8	Moderate	0.37	5	6
	8-60	0.06-0.2	0.13-0.23	7.4-9.0	<8	High-------	0.37		
93B--------------- Ekalaka	0-16	2.0-6.0	0.13-0.20	6.1-8.4	<2	Low--------	0.24	3	3
	16-29	0.06-0.2	0.11-0.13	8.5-9.0	2-8	Low--------	0.24		
	29-60	0.06-6.0	0.06-0.08	7.9-9.0	4-16	Low--------	0.24		
98---------------- Banks Variant	0-7	2.0-6.0	0.14-0.21	6.6-7.8	<2	Low--------	0.24	5	5
	7-60	6.0-20	0.07-0.09	7.4-8.4	<2	Low--------	0.17		
162*:									
Omio-------------	0-12	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low--------	0.32	5	6
	12-38	0.2-0.6	0.14-0.22	7.4-8.4	<2	Low--------	0.32		
	38-60	---	---	---	---	-----------	----		
Grassna----------	0-18	0.6-2.0	0.22-0.24	6.1-7.3	<2	Moderate	0.32	5	6
	18-60	0.6-2.0	0.16-0.22	6.6-8.4	<2	Moderate	0.32		
162B*, 162C*:									
Omio-------------	0-12	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low--------	0.32	5	6
	12-38	0.2-0.6	0.14-0.22	7.4-8.4	<2	Low--------	0.32		
	38-60	---	---	---	---	-----------	----		
Amor-------------	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-29	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	29-60	---	---	---	---	-----------	----		
164*, 164B*:									
Williams---------	0-5	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low--------	0.28	5	6
	5-14	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.28		
	14-60	0.06-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.37		
Falkirk----------	0-7	0.6-2.0	0.20-0.22	6.1-7.3	<2	Low--------	0.28	5	6
	7-22	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low--------	0.28		
	22-31	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low--------	0.28		
	31-60	0.2-0.6	0.14-0.16	7.4-8.4	<2	Moderate	0.37		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the text explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth		Uncoated steel	Concrete
					Ft			In			
3----------------- Regan	B/D	Frequent----	Brief to long.	Mar-Jun	0-1.0	Apparent	Oct-Jun	>60	High---------	High------	Low.
6B---------------- Niobell	C	None---------	---	---	>6.0	---	---	>60	Moderate----	High------	Moderate.
8----------------- Heil	D	Frequent----	Long------	Apr-Jun	0-1.0	Apparent	Sep-Jun	>60	Moderate----	High------	Moderate.
9----------------- Tonka	C/D	Frequent----	Long------	Apr-Jun	0-1.0	Apparent	Sep-Jun	>60	High---------	High------	Low.
10---------------- Parnell	C/D	Frequent----	Long------	Apr-Nov	0-2.0	Apparent	Jan-Dec	>60	High---------	High------	Low.
11---------------- Straw	B	Rare---------	---	---	>6.0	---	---	>60	Moderate----	High------	Moderate.
12---------------- Neche Variant	C	Frequent----	Long------	Apr-Nov	0-1.0	Apparent	Nov-Jun	>60	High---------	High------	Low.
13, 13B----------- Arnegard	B	None---------	---	---	>6.0	---	---	>60	Moderate----	High------	Low.
15D*, 15E*:											
Cabba------------	C	None---------	---	---	>6.0	---	---	8-20	Moderate----	High------	Moderate.
Amor-------------	B	None---------	---	---	>6.0	---	---	20-40	Moderate----	High------	Moderate.
17*, 17B*, 17C*:											
Stady------------	B	None---------	---	---	>6.0	---	---	>60	Moderate----	Moderate	Low.
Lehr-------------	B	None---------	---	---	>6.0	---	---	>60	Low----------	Moderate	Low.
18B*, 18C*:											
Reeder-----------	B	None---------	---	---	>6.0	---	---	20-40	Moderate----	High------	Moderate.
Rhoades----------	D	None---------	---	---	>6.0	---	---	>40	Low----------	High------	Low.
19---------------- Straw	B	Rare---------	---	---	>6.0	---	---	>60	Moderate----	High------	Moderate.
21, 21B----------- Shambo	B	None---------	---	---	>6.0	---	---	>60	Moderate----	Moderate	Low.
22*, 22B*:											
Belfield---------	C	None---------	---	---	>6.0	---	---	>60	Low----------	High------	Low.
Daglum-----------	D	None---------	---	---	>6.0	---	---	40-60	Moderate----	High------	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth		Uncoated steel	Concrete
					Ft			In			
23D*, 23E*:											
Vebar------------	B	None---------	---	---	>6.0	---	---	20-40	Low----------	Moderate	Low.
Cohagen----------	D	None---------	---	---	>6.0	---	---	4-20	Moderate-----	Moderate	Low.
24, 24B----------- Grassna	B	None---------	---	---	>6.0	---	---	>60	Moderate-----	High------	Low.
25B, 25C, 25D----- Flaxton	B	None---------	---	---	>6.0	---	---	>60	Moderate-----	High------	Low.
26B, 26C---------- Krem	A	None---------	---	---	>6.0	---	---	>60	Moderate-----	High------	Low.
28---------------- Grail	C	None---------	---	---	>6.0	---	---	>60	Moderate-----	High------	Low.
29---------------- Harriet	D	Occasional	Long------	Apr-Jun	0-1.0	Apparent	Sep-Jun	>60	High---------	High------	Moderate.
31---------------- Parnell	C/D	Frequent----	Long------	Apr-Nov	0-2.0	Apparent	Jan-Dec	>60	High---------	High------	Low.
32B, 32C---------- Lihen	A	None---------	---	---	>6.0	---	---	>60	Low----------	High------	Low.
33B*, 33C*:											
Parshall----------	B	None---------	---	---	>6.0	---	---	>60	Moderate-----	Moderate	Low.
Lihen-------------	A	None---------	---	---	>6.0	---	---	>60	Low----------	High------	Low.
35C, 35E---------- Sutley	B	None---------	---	---	>6.0	---	---	>60	Moderate-----	High------	Low.
36B, 36C---------- Bryant	B	None---------	---	---	>6.0	---	---	>60	Moderate-----	High------	Low.
40C*, 40D*:											
Amor--------------	B	None---------	---	---	>6.0	---	---	20-40	Moderate-----	High------	Moderate.
Cabba-------------	C	None---------	---	---	>6.0	---	---	8-20	Moderate-----	High------	Moderate.
41, 41B, 41C, 41D, 43D--------------- Reeder	B	None---------	---	---	>6.0	---	---	20-40	Moderate-----	High------	Moderate.
44*, 44C*:											
Daglum------------	D	None---------	---	---	>6.0	---	---	40-60	Moderate-----	High------	Low.
Rhoades-----------	D	None---------	---	---	>6.0	---	---	>40	Low----------	High------	Low.
46B*, 46C*:											
Regent------------	C	None---------	---	---	>6.0	---	---	20-40	Low----------	High------	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth		Uncoated steel	Concrete
					Ft			In			
46B*, 46C*:											
Daglum	D	None	---	---	>6.0	---	---	40-60	Moderate	High	Low.
47B Manning	B	None	---	---	>6.0	---	---	>60	Low	Moderate	Low.
49B Telfer	A	None	---	---	>6.0	---	---	>60	Low	Moderate	Low.
51B Noonan	D	None	---	---	>6.0	---	---	>60	Moderate	High	Moderate.
53, 53B, 53C Bearpaw	B	None	---	---	>6.0	---	---	>60	Moderate	High	Moderate.
54, 54B, 54C, 54D Regent	C	None	---	---	>6.0	---	---	20-40	Low	High	Moderate.
55C Rhoades	D	None	---	---	>6.0	---	---	>40	Low	High	Low.
58, 58B Bowdle	B	None	---	---	>6.0	---	---	>60	Low	Moderate	Low.
60B Farland	B	None	---	---	>6.0	---	---	>60	Moderate	High	Moderate.
62, 62B, 62C, 62D Amor	B	None	---	---	>6.0	---	---	20-40	Moderate	High	Moderate.
63D Wabek	A	None	---	---	>6.0	---	---	>60	Low	Moderate	Low.
64 Wilton	B	None	---	---	>6.0	---	---	>60	Moderate	Moderate	Low.
64B, 64C Temvik	B	None	---	---	>6.0	---	---	>60	Moderate	Moderate	Low.
66C, 66E Seroco	A	None	---	---	>6.0	---	---	>60	Low	Low	Low.
67B, 67C, 67D Vebar	B	None	---	---	>6.0	---	---	20-40	Low	Moderate	Low.
70*, 70B*:											
Williams	B	None	---	---	>6.0	---	---	>60	Moderate	High	Low.
Bowbells	B	None	---	---	>6.0	---	---	>60	Moderate	High	Low.
70C Williams	B	None	---	---	>6.0	---	---	>60	Moderate	High	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth		Uncoated steel	Concrete
					Ft			In			
72*, 72B*, 72C*:											
Williams	B	None	---	---	>6.0	---	---	>60	Moderate	High	Low.
Reeder	B	None	---	---	>6.0	---	---	20-40	Moderate	High	Moderate.
73C*, 73E*:											
Williams	B	None	---	---	>6.0	---	---	>60	Moderate	High	Low.
Zahl	B	None	---	---	>6.0	---	---	>60	Moderate	Moderate	Low.
79D*:											
Telfer	A	None	---	---	>6.0	---	---	>60	Low	Moderate	Low.
Flasher	D	None	---	---	>6.0	---	---	7-20	Low	Moderate	Low.
79E*:											
Flasher	D	None	---	---	>6.0	---	---	7-20	Low	Moderate	Low.
Telfer	A	None	---	---	>6.0	---	---	>60	Low	Moderate	Low.
82 Arveson	A/D	Rare	---	---	0-1.0	Apparent	Apr-Jul	>60	High	High	Low.
84 Havrelon Variant	B	Frequent	Brief	Mar-Jun	2.0-5.0	Apparent	Mar-Jun	>60	Moderate	High	Low.
85 Hamerly	C	None	---	---	1.5-3.0	Apparent	Sep-Jun	>60	High	High	Low.
88 Lallie	D	Frequent	Long	Apr-Jun	0-1.0	Apparent	Sep-Jun	>60	High	High	Moderate.
93B Ekalaka	B	None	---	---	>6.0	---	---	>60	Moderate	High	Moderate.
98 Banks Variant	A	Frequent	Brief	Mar-Jun	3.0-6.0	Apparent	Mar-Jun	>60	Low	Moderate	Low.
162*:											
Omio	B	None	---	---	>6.0	---	---	20-40	Moderate	Moderate	Low.
Grassna	B	None	---	---	>6.0	---	---	>60	Moderate	High	Low.
162B*, 162C*:											
Omio	B	None	---	---	>6.0	---	---	20-40	Moderate	Moderate	Low.
Amor	B	None	---	---	>6.0	---	---	20-40	Moderate	High	Moderate.
164*, 164B*:											
Williams	B	None	---	---	>6.0	---	---	>60	Moderate	High	Low.
Falkirk	B	None	---	---	>6.0	---	---	>60	Moderate	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								Liquid limit	Plasticity index	Moisture density		Shrinkage		
			Percentage passing sieve--					Percentage smaller than--									
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Maximum density	Optimum moisture	Limit	Linear	Ratio
											Pct		Lb/ft3	Pct	Pct	Pct	Pct
Amor loam: (S76ND-029-003)																	
B3--------10 to 18	A-6(08)	CL	100	100	100	100	74	--	20	--	34	12	110	16	18.0	0.0	1.7
C2ca------27 to 34	A-6(05)	CL	100	100	100	100	63	--	20	--	31	11	109	16	16.0	0.0	1.7
Arnegard loam: (S76ND-029-007)																	
B2--------15 to 32	A-6(06)	CL	100	100	100	100	54	--	18	--	30	19	112	15	18.0	0.0	1.7
B3--------32 to 42	A-4(02)	CL	100	100	100	100	53	--	16	--	29	8	115	15	18.0	0.0	1.7
Bryant silt loam: (S76ND-029-009)																	
B2-------- 8 to 20	A-6(12)	CL	100	100	100	100	84	--	25	--	36	14	116	14	18.0	0.0	1.7
Cca-------20 to 60	A-4(07)	ML	100	100	100	100	86	--	23	--	32	8	120	13	18.0	0.0	1.7
Daglum silt loam: (S76ND-029-006)																	
B21t------ 9 to 13	A-6(10)	CL	100	100	100	99	70	--	27	--	35	17	113	15	15.0	0.0	1.8
C1cs------18 to 25	A-7-6(17)	CL	100	100	100	98	66	--	35	--	48	28	111	16	15.0	0.0	1.8
Parshall fine sandy loam: (S76ND-029-008)																	
B2--------14 to 28	A-4(00)	SM	100	100	100	100	47	--	14	--	--	NP	120	13	0.0	0.0	0.0
C1--------28 to 38	A-4(00)	SM	100	100	100	100	43	--	14	--	--	NP	120	13	0.0	0.0	0.0
Regent silty clay loam: (S76ND-029-013)																	
B22t------17 to 28	A-7-6(23)	CL	100	100	100	100	82	--	50	--	49	27	108	17	10.0	0.0	2.0
Cr3-------53 to 60	A-7-6(12)	CL	100	100	100	100	58	--	40	--	44	25	112	15	15.0	0.0	1.8
Temvik silt loam: (S76ND-029-014)																	
B2-------- 5 to 13	A-6(07)	CL	100	100	100	99	63	--	25	--	36	15	112	15	17.0	0.0	1.7
IIC2------34 to 60	A-6(07)	CL	100	100	100	99	57	--	38	--	34	18	114	15	16.0	0.0	1.8
Williams loam: (S76ND-029-010)																	
B2t------- 5 to 14	A-7-6(13)	CL	100	99	97	96	70	--	40	--	41	21	109	16	15.0	0.0	1.8
C2--------23 to 42	A-6(09)	CL	100	100	98	98	64	--	27	--	37	17	108	17	17.0	0.0	1.7

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Amor	Fine-loamy, mixed Typic Haploborolls
Arnegard	Fine-loamy, mixed Pachic Haploborolls
Arveson	Coarse-loamy, frigid Typic Calciaquolls
Banks Variant	Sandy, mixed, frigid Aeric Fluvaquents
Bearpaw	Fine, montmorillonitic Typic Argiborolls
Belfield	Fine, montmorillonitic Glossic Natriborolls
Bowbells	Fine-loamy, mixed Pachic Argiborolls
Bowdle	Fine-loamy over sandy or sandy-skeletal, mixed Pachic Haploborolls
Bryant	Fine-silty, mixed Typic Haploborolls
Cabba	Loamy, mixed (calcareous), frigid, shallow Typic Ustorthents
Cohagen	Loamy, mixed (calcareous), frigid, shallow Typic Ustorthents
Daglum	Fine, montmorillonitic Typic Natriborolls
Ekalaka	Coarse-loamy, mixed Typic Natriborolls
*Falkirk	Fine-loamy, mixed Pachic Haploborolls
Farland	Fine-silty, mixed Typic Argiborolls
Flasher	Mixed, frigid, shallow Typic Ustipsamments
*Flaxton	Fine-loamy, mixed Pachic Argiborolls
Grail	Fine, montmorillonitic Pachic Argiborolls
Grassna	Fine-silty, mixed Pachic Haploborolls
Hamerly	Fine-loamy, frigid Aeric Calciaquolls
Harriet	Fine, mixed, frigid Typic Natraquolls
Havrelon Variant	Fine-loamy, mixed (calcareous), frigid Aeric Fluvaquents
Heil	Fine, montmorillonitic, frigid Typic Natraquolls
Krem	Sandy over loamy, mixed Typic Argiborolls
Lallie	Fine, montmorillonitic (calcareous), frigid Typic Fluvaquents
Lehr	Fine-loamy over sandy or sandy-skeletal, mixed Typic Haploborolls
Lihen	Sandy, mixed Entic Haploborolls
Manning	Coarse-loamy over sandy or sandy-skeletal, mixed Typic Haploborolls
Neche Variant	Fine loamy, mixed (calcareous), frigid Fluvaquentic Haplaquolls
Niobell	Fine-loamy, mixed Glossic Natriborolls
Noonan	Fine-loamy, mixed Typic Natriborolls
Omio	Fine-silty, mixed Typic Haploborolls
Parnell	Fine, montmorillonitic, frigid Typic Argiaquolls
Parshall	Coarse-loamy, mixed Pachic Haploborolls
Reeder	Fine-loamy, mixed Typic Argiborolls
Regan	Fine-silty, frigid Typic Calciaquolls
Regent	Fine, montmorillonitic Typic Argiborolls
Rhoades	Fine, montmorillonitic Leptic Natriborolls
Seroco	Mixed, frigid Typic Ustipsamments
Shambo	Fine-loamy, mixed Typic Haploborolls
Stady	Fine-loamy over sandy or sandy-skeletal, mixed Typic Haploborolls
*Straw	Fine-loamy, mixed Cumulic Haploborolls
Sutley	Coarse-silty, mixed Entic Haploborolls
Telfer	Sandy, mixed Entic Haploborolls
Temvik	Fine-silty, mixed Typic Haploborolls
Tonka	Fine, montmorillonitic, frigid Argiaquic Argialbolls
Vebar	Coarse-loamy, mixed Typic Haploborolls
Wabek	Sandy-skeletal, mixed Entic Haploborolls
Williams	Fine-loamy, mixed Typic Argiborolls
Wilton	Fine-silty, mixed Pachic Haploborolls
Zahl	Fine-loamy, mixed Entic Haploborolls

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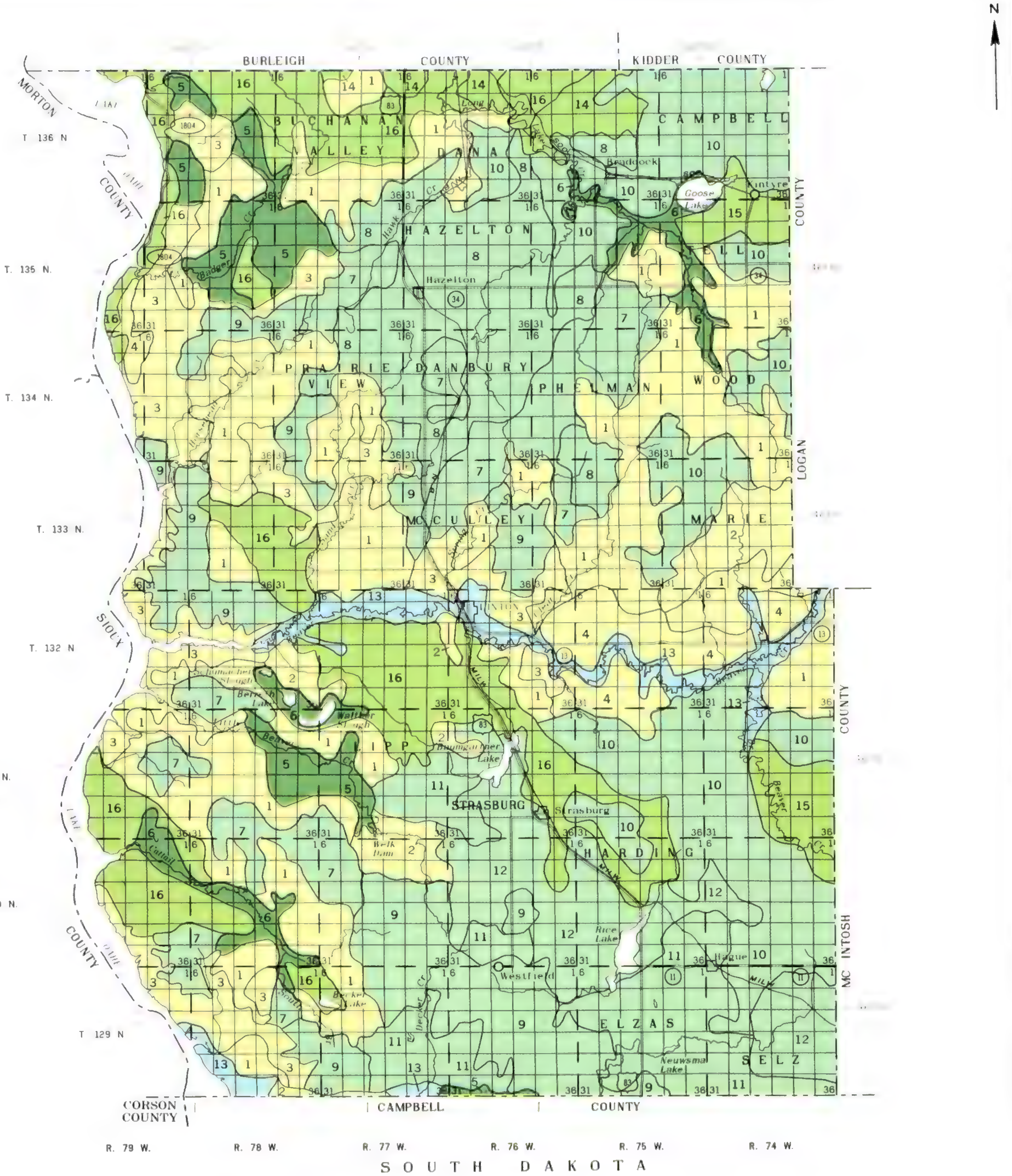


SOIL LEGEND*

SHALLOW AND MODERATELY DEEP, NEARLY LEVEL TO VERY STEEP SOILS ON UPLANDS

1 Amor–Vebar association: Moderately deep, nearly level to strongly sloping, well drained, medium textured and moderately coarse textured soils formed in material weathered from sandstone, siltstone, and shale

2 Vebar–Cohagen–Flasher association: Moderately deep and shallow, nearly level to strongly sloping, well drained and somewhat excessively drained, moderately coarse textured and coarse textured soils formed in material weathered from sandstone and shale

3 Cabba–Amor association: Shallow and moderately deep, hilly to very steep, well drained, medium textured soils formed in material weathered from siltstone, shale, and sandstone

4 Reeder–Cabba association: Moderately deep and shallow, nearly level to steep, well drained, medium textured soils formed in material weathered from siltstone, shale, and sandstone

DEEP, LEVEL TO MODERATELY SLOPING, SODIC SOILS ON TERRACES AND UPLANDS AND IN UPLAND DRAINAGEWAYS

5 Rhoades–Daglum–Belfield association: Deep, nearly level to moderately sloping, moderately well drained and well drained, medium textured soils formed in material weathered from shale and in alluvium

6 Harriet association: Deep, level, poorly drained, medium textured soils formed in alluvium

DEEP AND MODERATELY DEEP, NEARLY LEVEL TO HILLY SOILS ON UPLANDS

7 Omio–Grassna association: Moderately deep and deep, nearly level to moderately sloping, well drained, medium textured soils formed in loess and in material weathered from sandstone, siltstone, and shale

8 Temvik–Wilton–Grassna association: Deep, nearly level to moderately sloping, well drained, medium textured soils formed in loess and glacial till

9 Bryant–Grassna association: Deep, nearly level to moderately sloping, well drained, medium textured soils formed in loess

10 Williams–Zahl association: Deep, nearly level to hilly, well drained, medium textured soils formed in glacial till

11 Bearpaw–Noonan association: Deep, nearly level to gently rolling, well drained, medium textured soils formed in glacial till

12 Williams–Falkirk association: Deep, nearly level and undulating, well drained, medium textured soils formed in glacial till and glaciofluvial material

DEEP, NEARLY LEVEL SOILS ON FLOOD PLAINS

13 Straw association: Deep, nearly level, well drained, medium textured soils formed in alluvium

DEEP, NEARLY LEVEL TO ROLLING SOILS ON UPLANDS, TERRACES, AND OUTWASH PLAINS

14 Flaxton–Krem association: Deep, nearly level to rolling, well drained, moderately coarse textured and coarse textured soils formed in eolian deposits and glacial till

15 Stady–Lehr association: Deep, nearly level to moderately sloping, well drained and somewhat excessively drained, medium textured soils formed in alluvium underlain by sand and gravel

16 Lihen–Parshall association: Deep, nearly level to moderately sloping, well drained, coarse textured and moderately coarse textured soils formed in eolian material and in alluvium

* Texture terms in the descriptive headings refer to the surface layer of the major soils in each association.

Compiled 1979

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

EMMONS COUNTY, NORTH DAKOTA

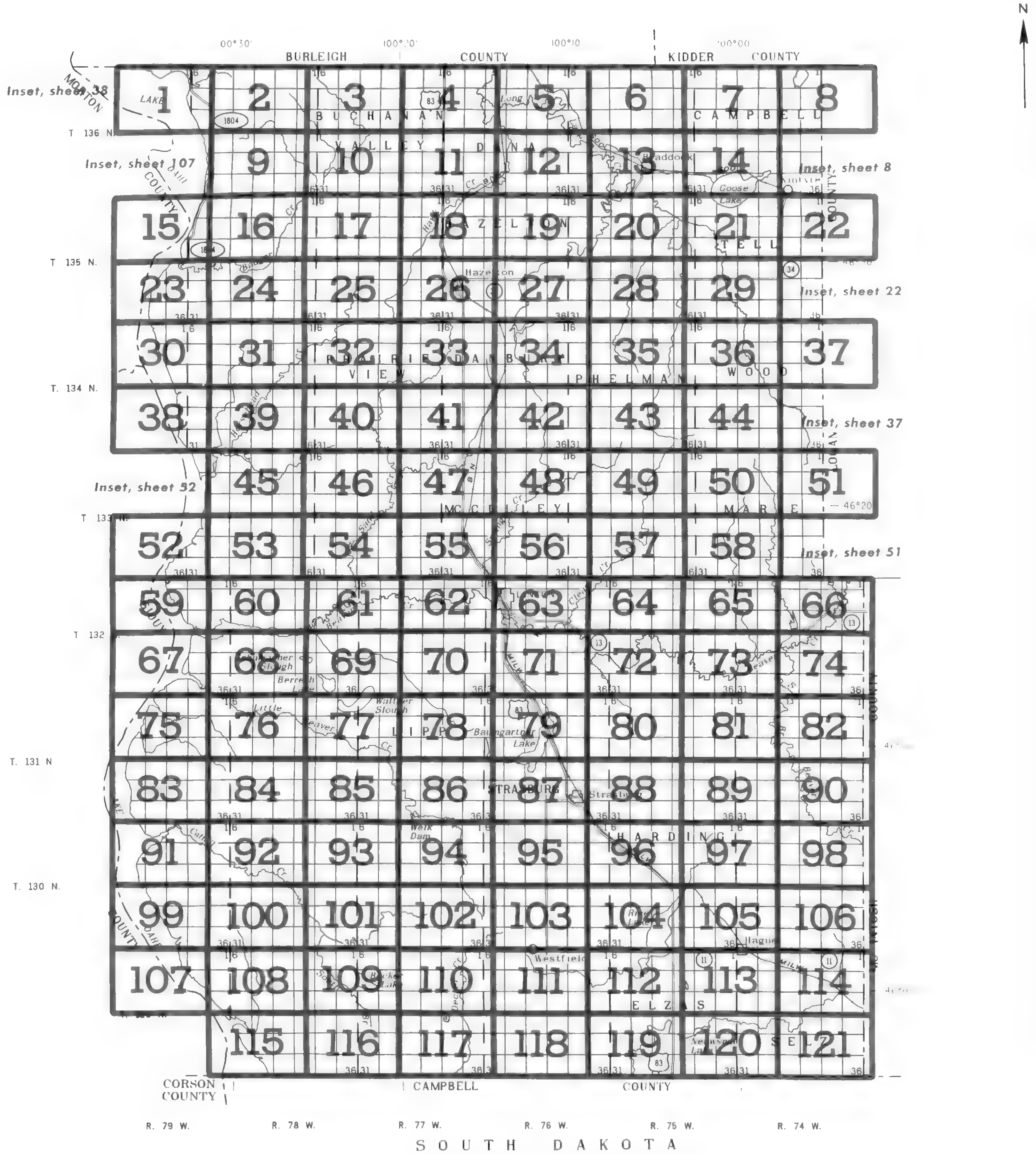
Scale 1: 316,800

1 0 1 2 3 4 5 Miles

1 0 1 2 3 4 5 6 7 8 Kilometers

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



Original text from each individual map sheet read:
This map is compiled on 1974 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

INDEX TO MAP SHEETS
EMMONS COUNTY, NORTH DAKOTA

Scale 1: 316,800
1 0 1 2 3 4 5 Miles
1 0 1 2 3 4 5 6 7 8 Kilometers

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

Davis Airstrip
FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS
(sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate 78
- Federal 410
- State 52
- County, farm or ranch 378

RAILROAD

POWER TRANSMISSION LINE
(normally not shown)

PIPE LINE
(normally not shown)

FENCE
(normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

water
w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) Indian Mound
- Located object (label) Tower
- Tank (label) GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial water w
- Intermittent int i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS 22 162B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE
(normally not shown)

MISCELLANEOUS

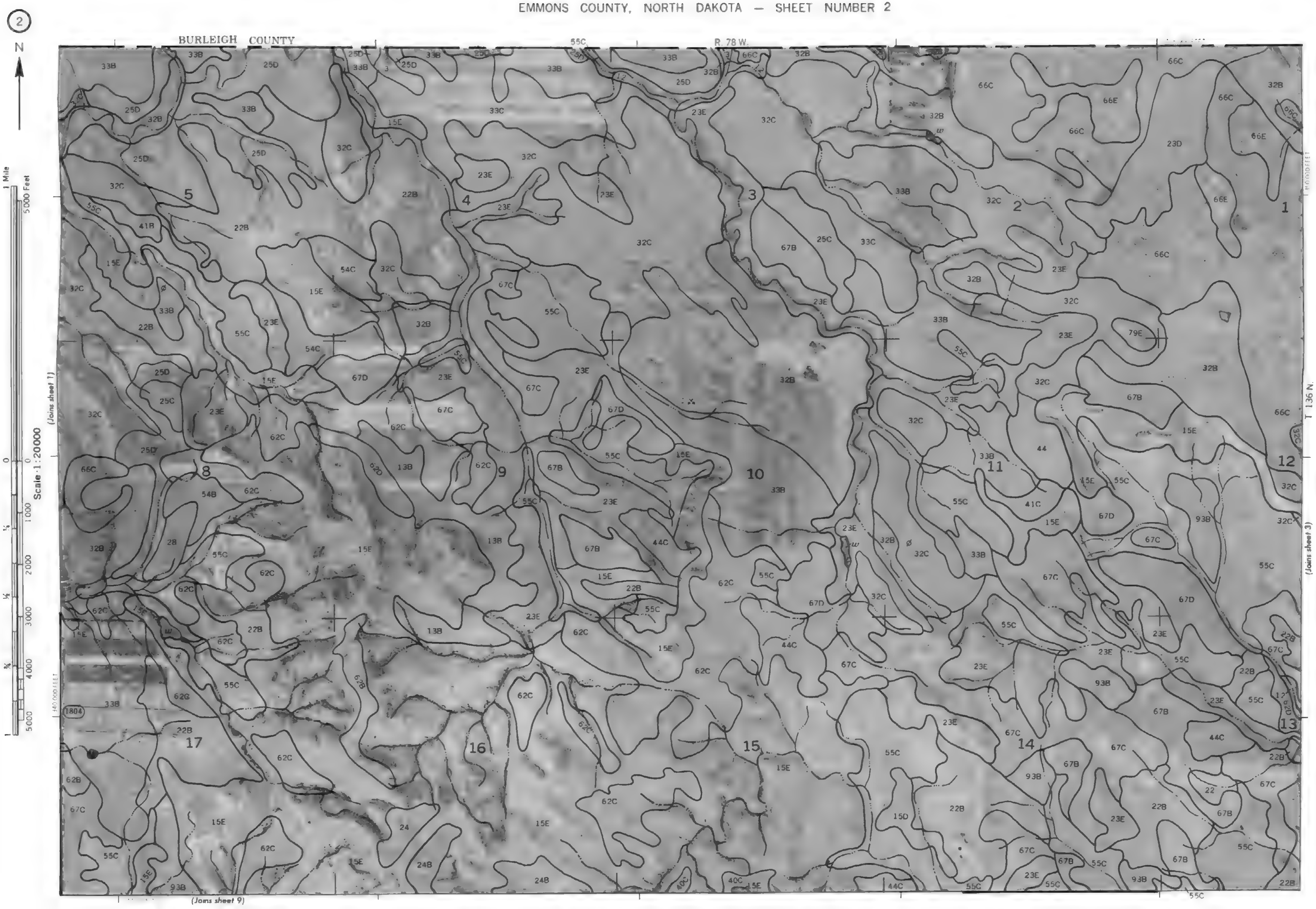
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

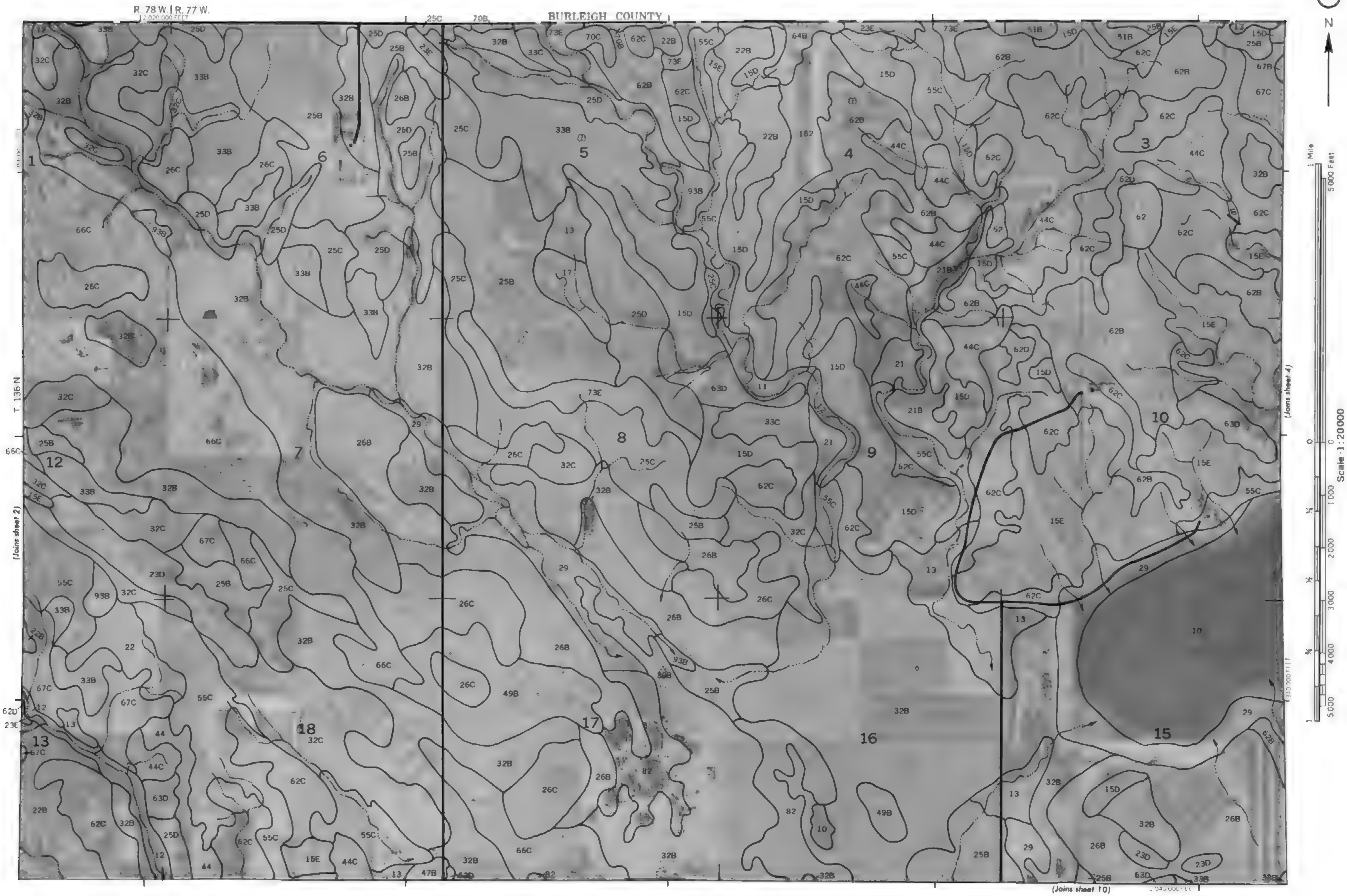
SOIL LEGEND

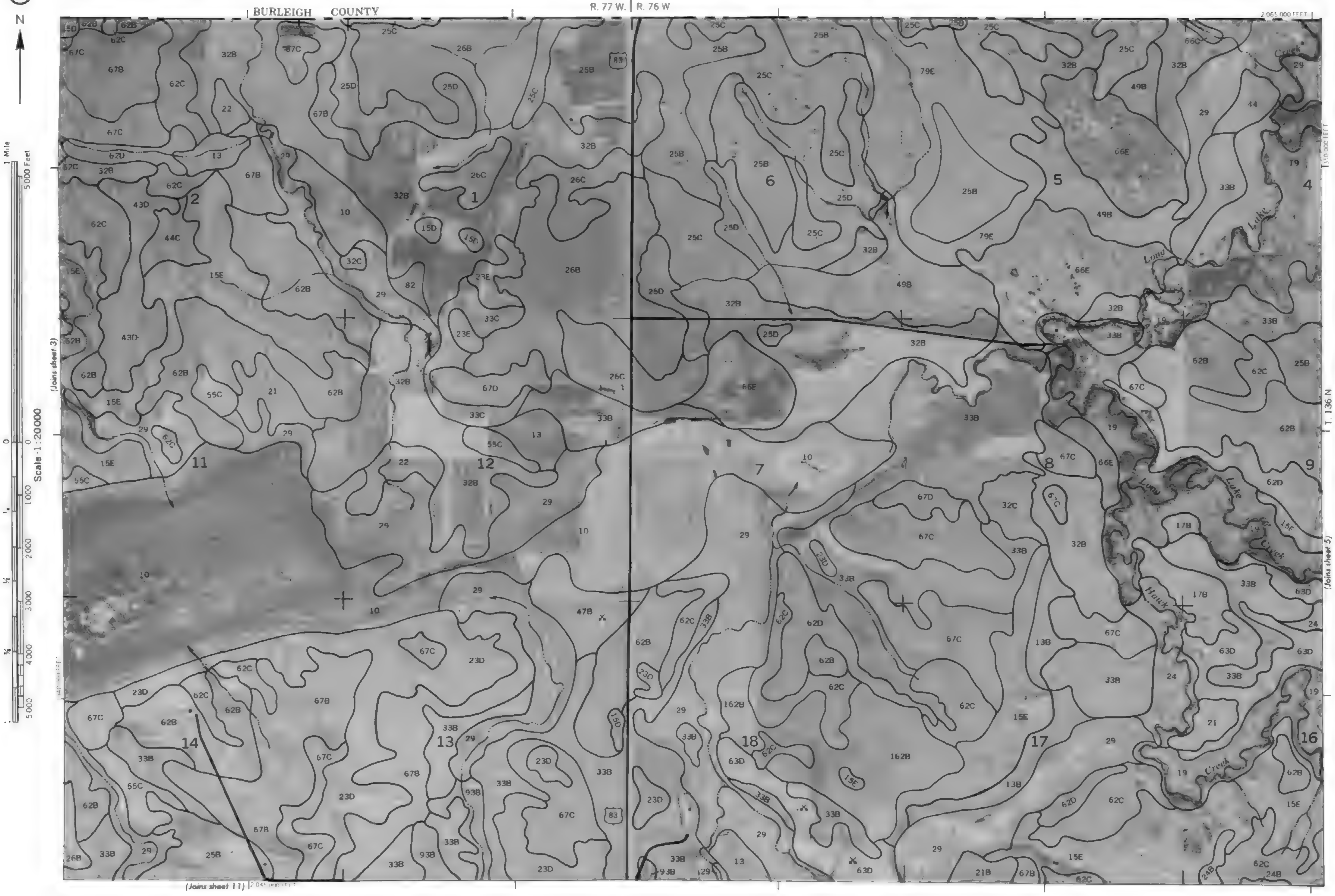
Map symbols consist of numbers or a combination of numbers and letters. The numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils.

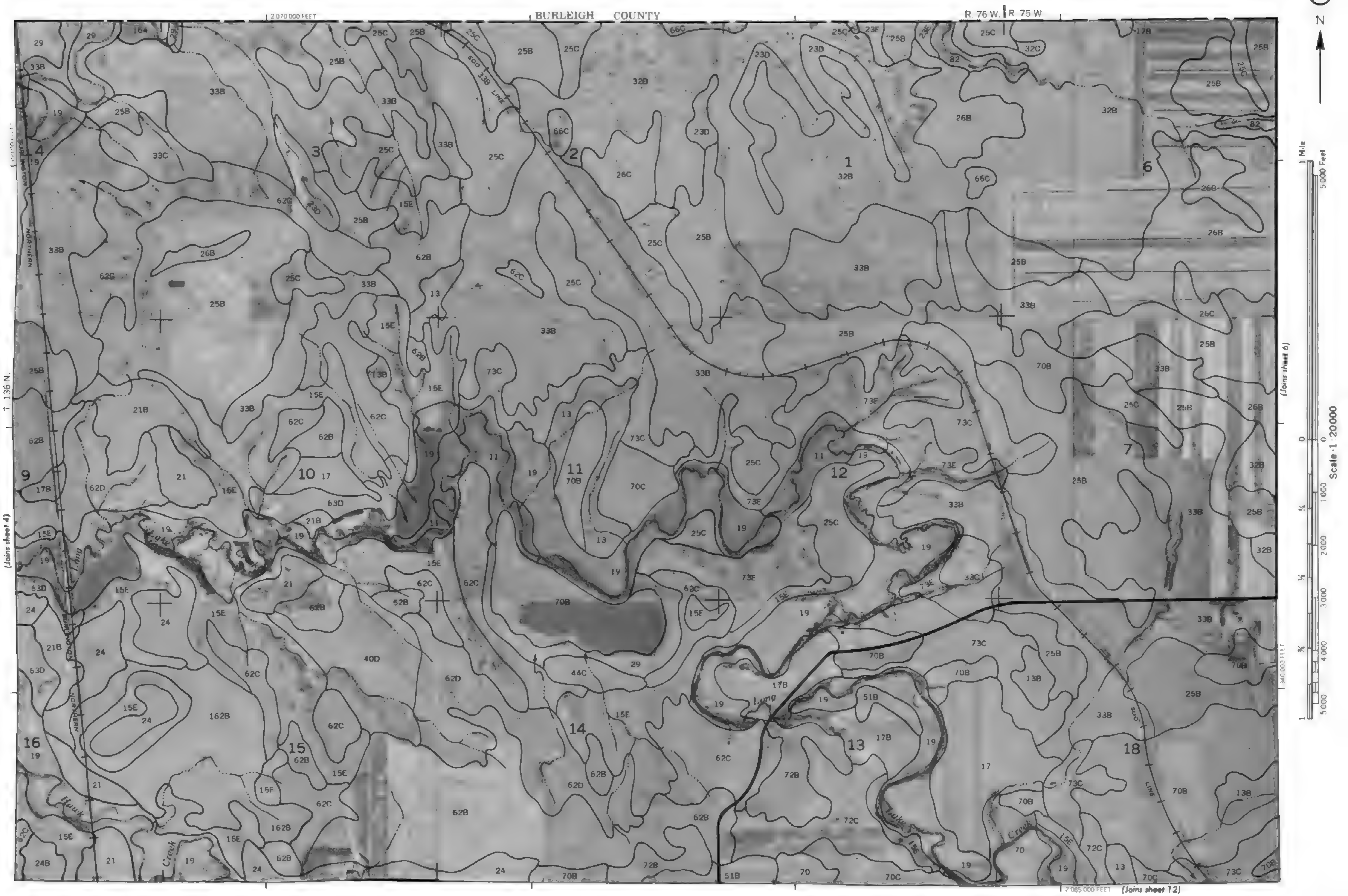
SYMBOL	NAME
3	Regan silt loam
6B	Niobell loam, 1 to 6 percent slopes
8	Heil silt loam
9	Tonka silt loam
10	Parnell silt loam
11	Straw silt loam, channeled
12	Neche Variant loam
13	Arnegard loam, 1 to 3 percent slopes
13B	Arnegard loam, 3 to 6 percent slopes
15D	Cabba–Amor loams, 9 to 15 percent slopes
15E	Cabba–Amor loams, 15 to 50 percent slopes
17	Stady–Lehr loams, 1 to 3 percent slopes
17B	Stady–Lehr loams, 3 to 6 percent slopes
17C	Stady–Lehr loams, 6 to 9 percent slopes
18B	Reeder–Rhoades silt loams, 3 to 6 percent slopes
18C	Reeder–Rhoades silt loams, 6 to 9 percent slopes
19	Straw silt loam, 1 to 3 percent slopes
21	Shambo loam, 1 to 3 percent slopes
21B	Shambo loam, 3 to 6 percent slopes
22	Belfield–Daglum silt loams, 1 to 3 percent slopes
22B	Belfield–Daglum silt loams, 3 to 6 percent slopes
23D	Vebar–Cohagen fine sandy loams, 9 to 15 percent slopes
23E	Vebar–Cohagen fine sandy loams, 15 to 50 percent slopes
24	Grassna silt loam, 1 to 3 percent slopes
24B	Grassna silt loam, 3 to 6 percent slopes
25B	Flaxton fine sandy loam, 1 to 6 percent slopes
25C	Flaxton fine sandy loam, 6 to 9 percent slopes
25D	Flaxton fine sandy loam, 9 to 15 percent slopes
26B	Krem loamy fine sand, 1 to 6 percent slopes
26C	Krem loamy fine sand, 6 to 9 percent slopes
28	Grail silty clay loam, 1 to 3 percent slopes
29	Harriet silt loam
31	Parnell silty clay loam, ponded
32B	Lihen loamy fine sand, 1 to 6 percent slopes
32C	Lihen loamy fine sand, 6 to 9 percent slopes
33B	Parshall–Lihen fine sandy loams, 1 to 6 percent slopes
33C	Parshall–Lihen fine sandy loams, 6 to 9 percent slopes
35C	Sutley silt loam, 3 to 9 percent slopes
35E	Sutley silt loam, 9 to 35 percent slopes
36B	Bryant silt loam, 3 to 6 percent slopes
36C	Bryant silt loam, 6 to 9 percent slopes
40C	Amor–Cabba loams, 6 to 9 percent slopes
40D	Amor–Cabba loams, 9 to 15 percent slopes
41	Reeder loam, 1 to 3 percent slopes
41B	Reeder loam, 3 to 6 percent slopes
41C	Reeder loam, 6 to 9 percent slopes
41D	Reeder loam, 9 to 15 percent slopes
43D	Reeder extremely stony loam, 1 to 15 percent slopes
44	Daglum–Rhoades silt loams, 1 to 3 percent slopes
44C	Daglum–Rhoades silt loams, 3 to 9 percent slopes
46B	Regent–Daglum silty clay loams, 3 to 6 percent slopes
46C	Regent–Daglum silty clay loams, 6 to 9 percent slopes
47B	Manning fine sandy loam, 1 to 6 percent slopes
49B	Telfer loamy fine sand, 1 to 6 percent slopes
51B	Noonan loam, 1 to 6 percent slopes
53	Bearpaw silt loam, 1 to 3 percent slopes
53B	Bearpaw silt loam, 3 to 6 percent slopes
53C	Bearpaw silt loam, 6 to 9 percent slopes
54	Regent silty clay loam, 1 to 3 percent slopes
54B	Regent silty clay loam, 3 to 6 percent slopes
54C	Regent silty clay loam, 6 to 9 percent slopes
54D	Regent silty clay loam, 9 to 15 percent slopes
55C	Rhoades silt loam, 1 to 9 percent slopes
58	Bowdle loam, 1 to 3 percent slopes
58B	Bowdle loam, 3 to 6 percent slopes
60B	Farland silt loam, 1 to 6 percent slopes
62	Amor loam, 1 to 3 percent slopes
62B	Amor loam, 3 to 6 percent slopes
62C	Amor loam, 6 to 9 percent slopes
62D	Amor loam, 9 to 15 percent slopes
63D	Wabek loam, 6 to 15 percent slopes
64	Wilton silt loam, 1 to 3 percent slopes
64B	Temvik silt loam, 3 to 6 percent slopes
64C	Temvik silt loam, 6 to 9 percent slopes
66C	Seroco fine sand, 1 to 9 percent slopes
66E	Seroco fine sand, 3 to 35 percent slopes
67B	Vebar fine sandy loam, 1 to 6 percent slopes
67C	Vebar fine sandy loam, 6 to 9 percent slopes
67D	Vebar fine sandy loam, 9 to 15 percent slopes
70	Williams–Bowbells loams, 1 to 3 percent slopes
70B	Williams–Bowbells loams, 3 to 6 percent slopes
70C	Williams loam, 6 to 9 percent slopes
72	Williams–Reeder loams, 1 to 3 percent slopes
72B	Williams–Reeder loams, 3 to 6 percent slopes
72C	Williams–Reeder loams, 6 to 9 percent slopes
73C	Williams–Zahl loams, 6 to 9 percent slopes
73E	Williams–Zahl loams, 9 to 25 percent slopes
79D	Telfer–Flasher loamy fine sands, 6 to 15 percent slopes
79E	Flasher–Telfer loamy fine sands, 15 to 35 percent slopes
82	Arveson loam
84	Havrelon Variant silt loam
85	Hamerly loam, 1 to 3 percent slopes
88	Lallie silt loam
93B	Ekalaka fine sandy loam, 1 to 6 percent slopes
98	Banks Variant very fine sandy loam
162	Omio–Grassna silt loams, 0 to 3 percent slopes
162B	Omio–Amor silt loams, 3 to 6 percent slopes
162C	Omio–Amor silt loams, 6 to 9 percent slopes
164	Williams–Falkirk loams, 1 to 3 percent slopes
164B	Williams–Falkirk loams, 3 to 6 percent slopes


BURLEIGH COUNTY
R. 79 W.
R. 78 W.
T. 136 N.
LAKE OAHE
MORTON COUNTY
INDEFINITE BOUNDARY
water
(Joins inset, sheet 38)
(Joins sheet 2)
(Joins inset, sheet 107)
1 990 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
1804


2
N
BURLEIGH COUNTY
R. 78 W.
T. 136 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 9)
Scale 1:20000
1 Mile
5000 Feet
1804

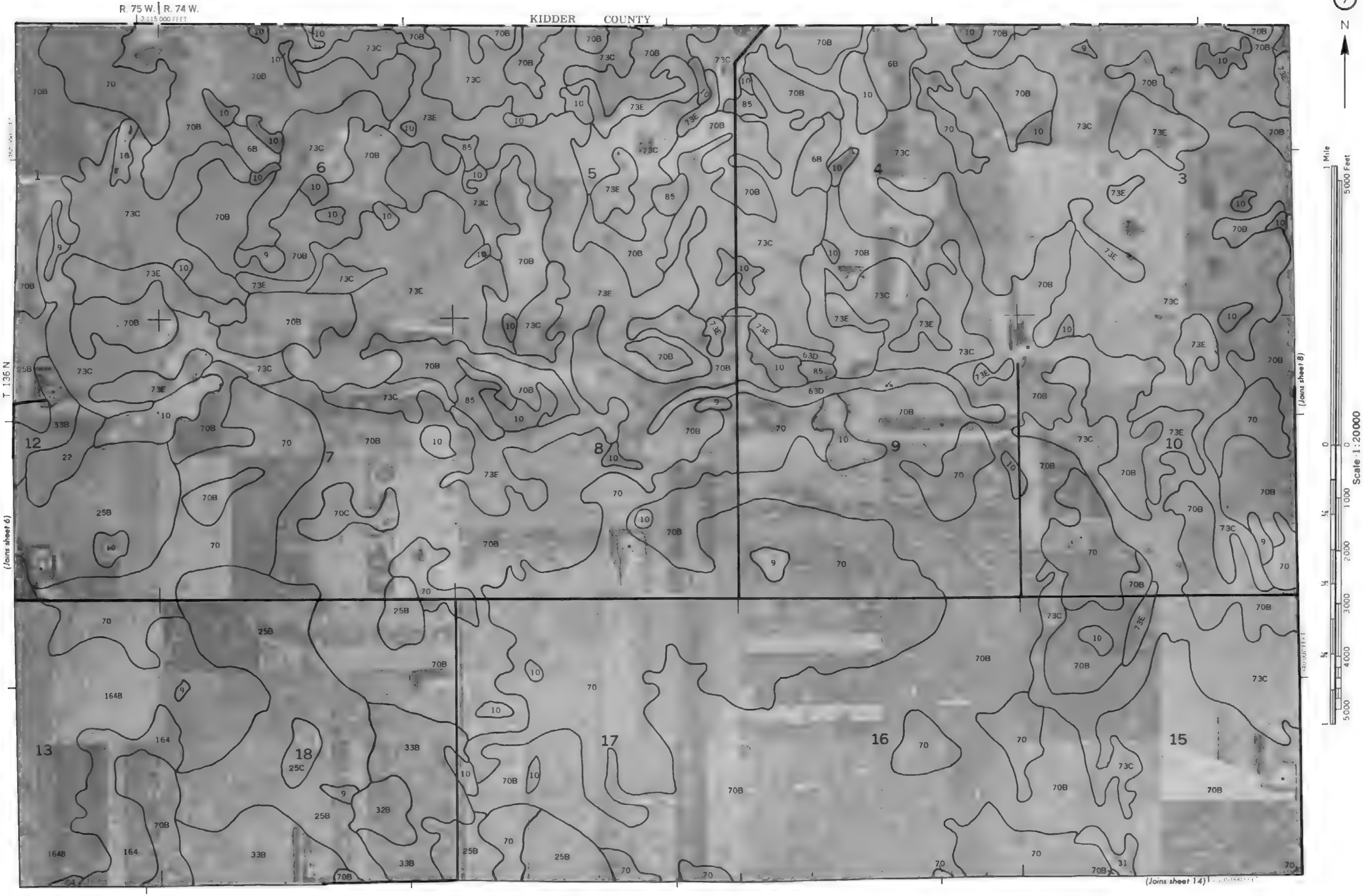

3
N
R. 78 W. | R. 77 W.
BURLEIGH COUNTY
T. 136 N
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 10)
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000

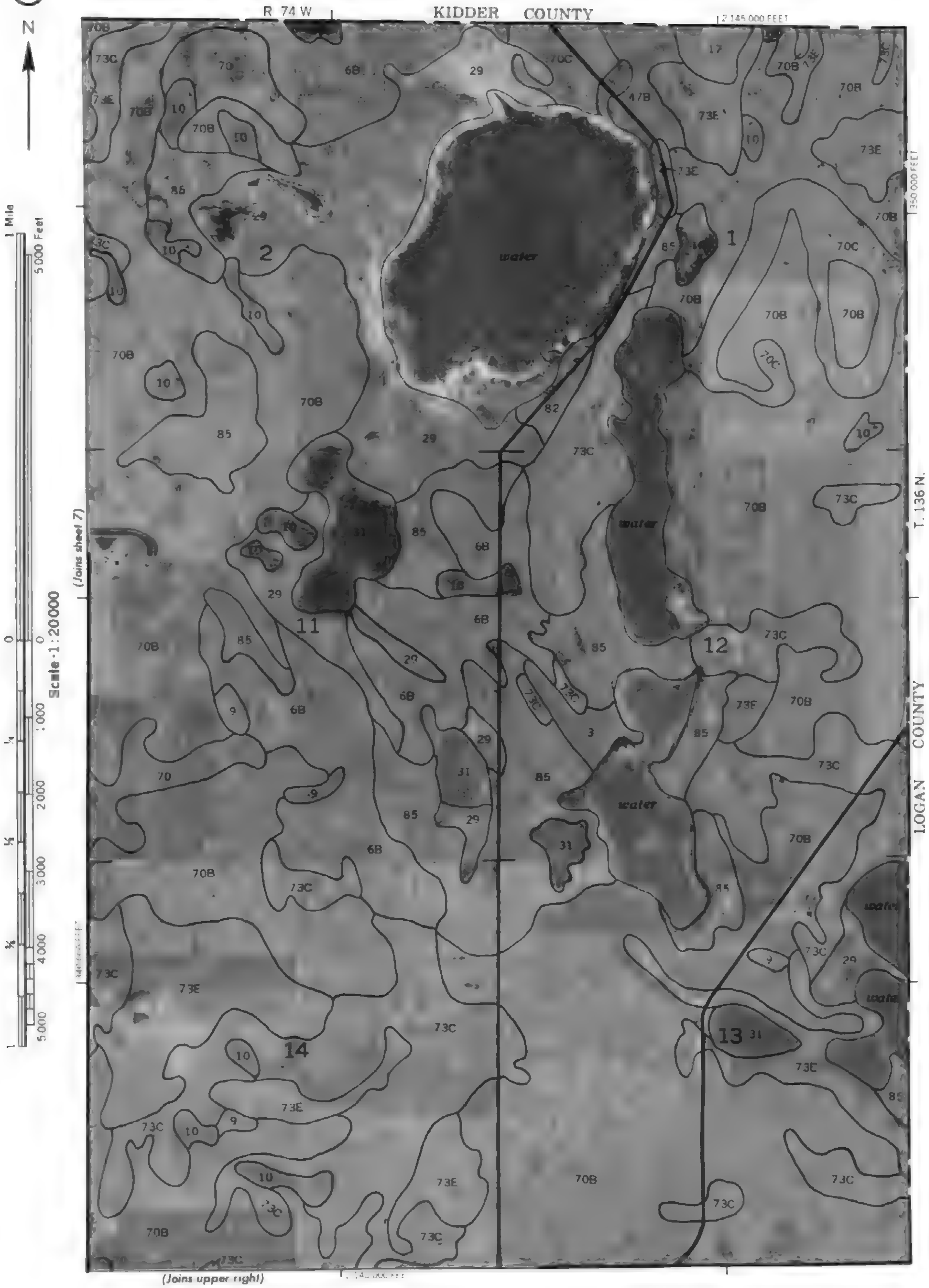

4
N
BURLEIGH COUNTY
R. 77 W.
R. 76 W
T. 136 N
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 11)
Long Lake Creek
Hawk Creek
83
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
½
¼
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18

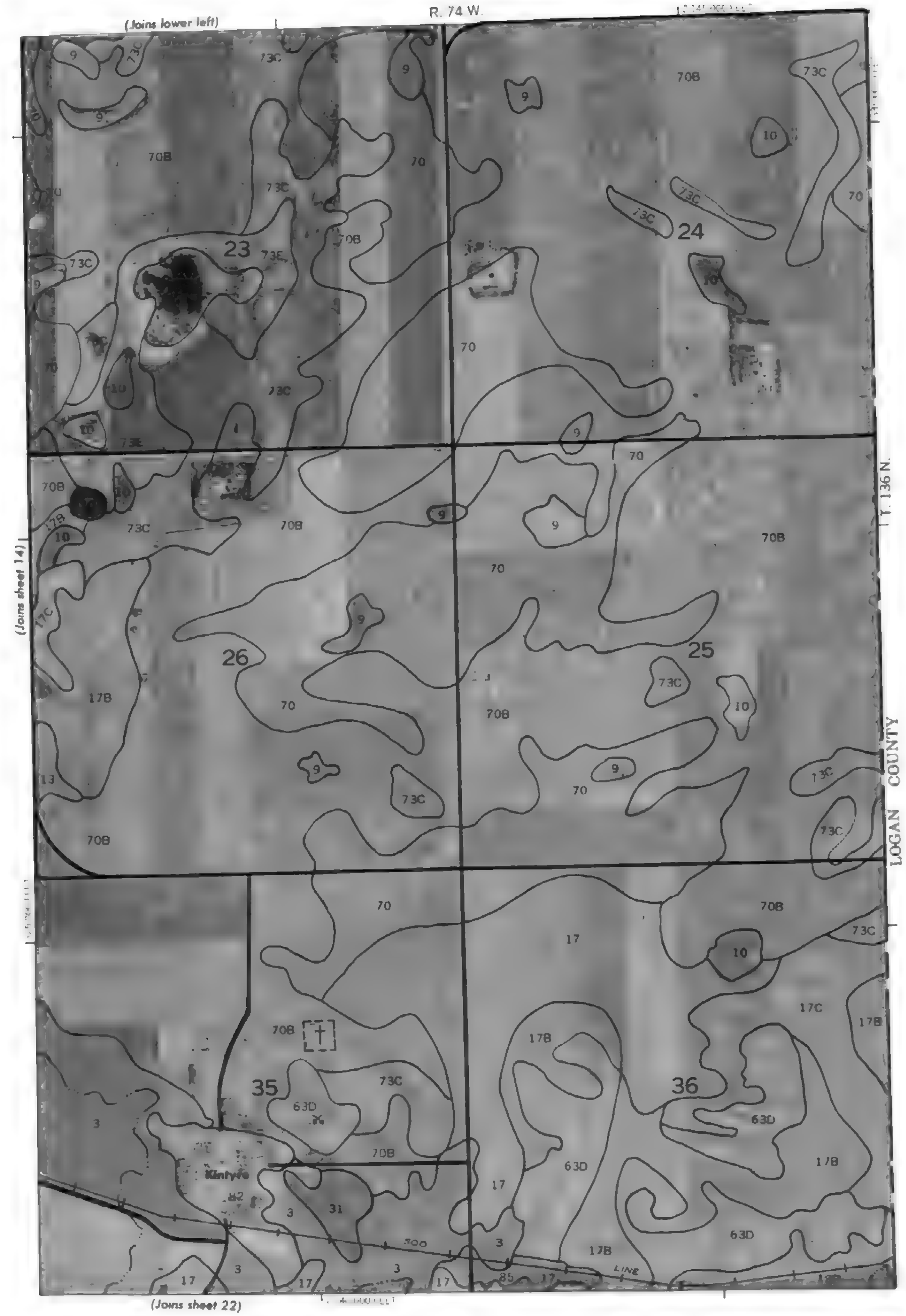

5
N
BURLEIGH COUNTY
R. 76 W. | R. 75 W.
T. 136 N.
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 12)
Long Lake Creek
Hawk Creek
1 Mile
5000 Feet
Scale 1:20000

6

EMMONS COUNTY, NORTH DAKOTA — SHEET NUMBER 6


R. 75 W.
R. 74 W.
2 115 000 FEET
KIDDER COUNTY
7
N
T 136 N
(Joins sheet 6)
(Joins sheet 8)
(Joins sheet 14)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000


N
1 Mile
5 000 Feet
Scale 1:20000
R. 74 W.
KIDDER COUNTY
(Joins sheet 7)
T. 136 N.
LOGAN COUNTY
water
(Joins upper right)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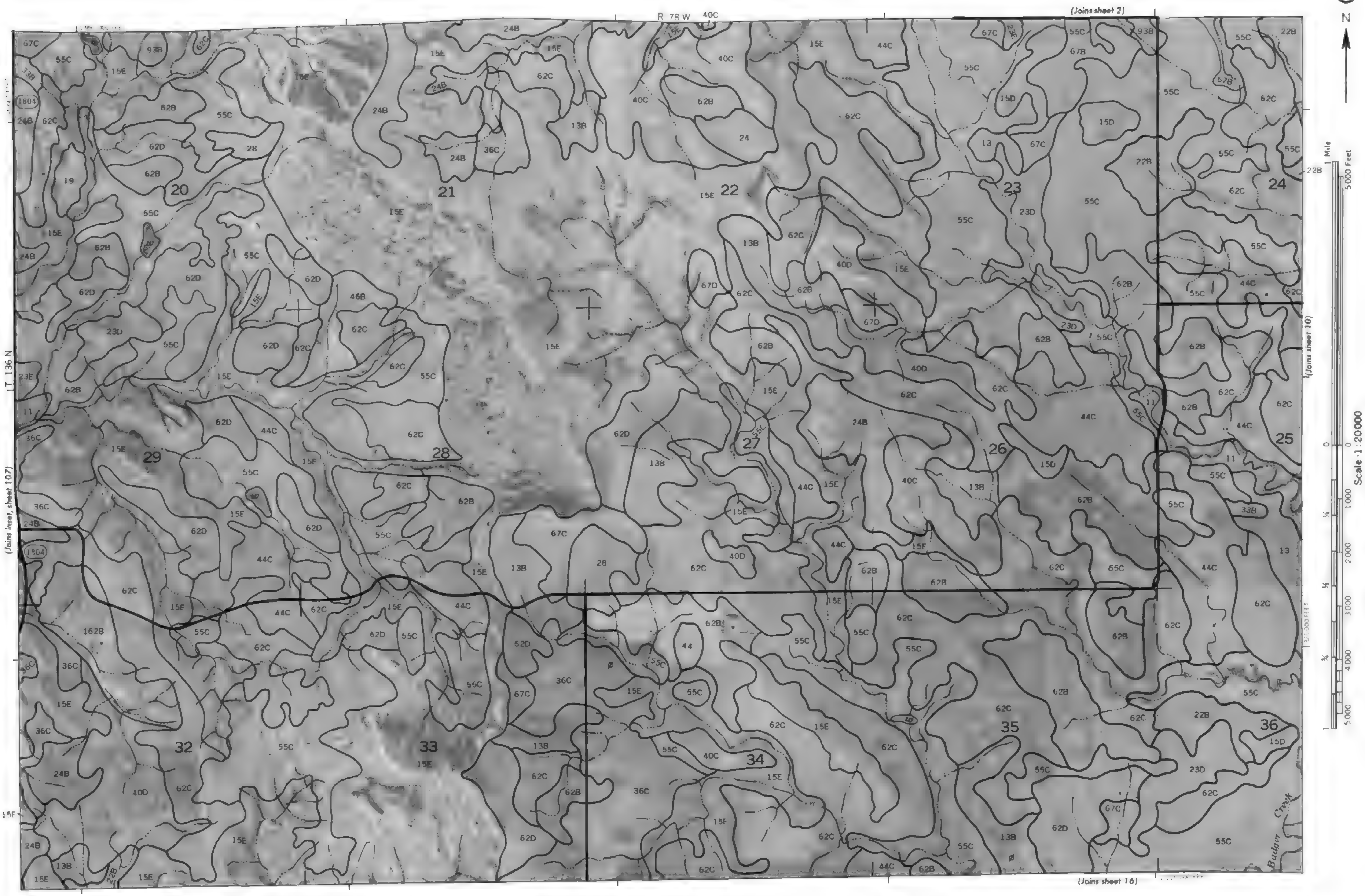
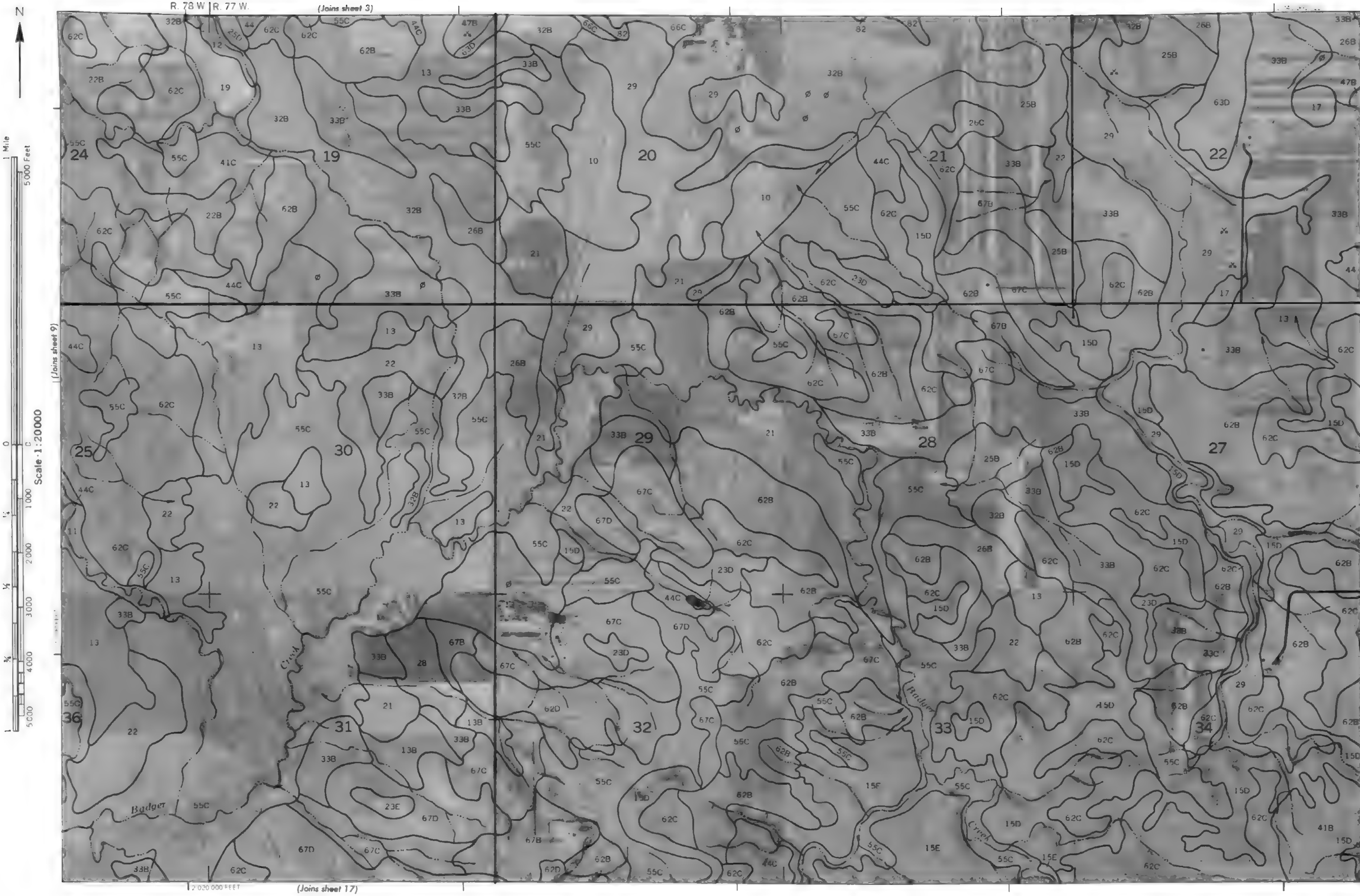
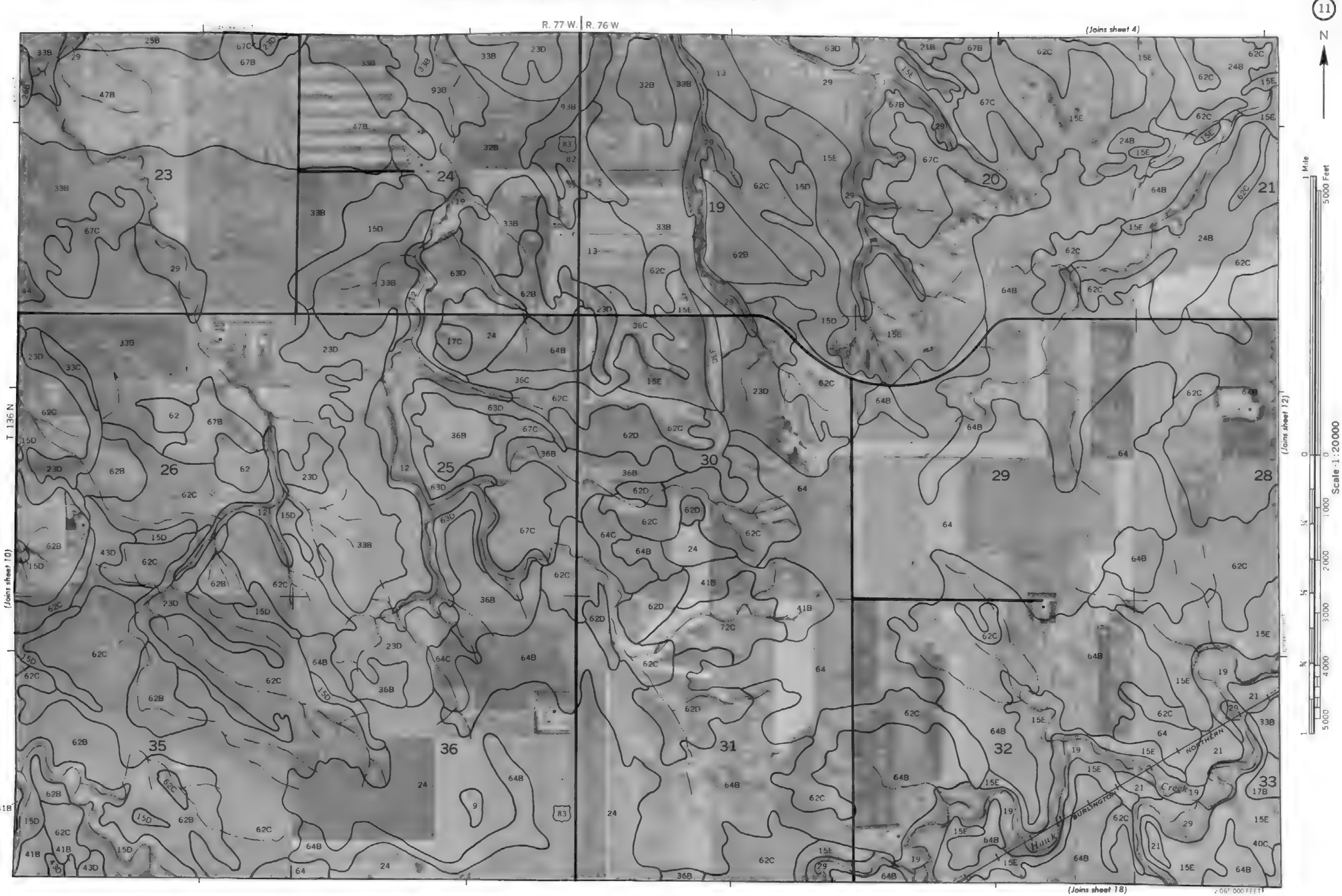
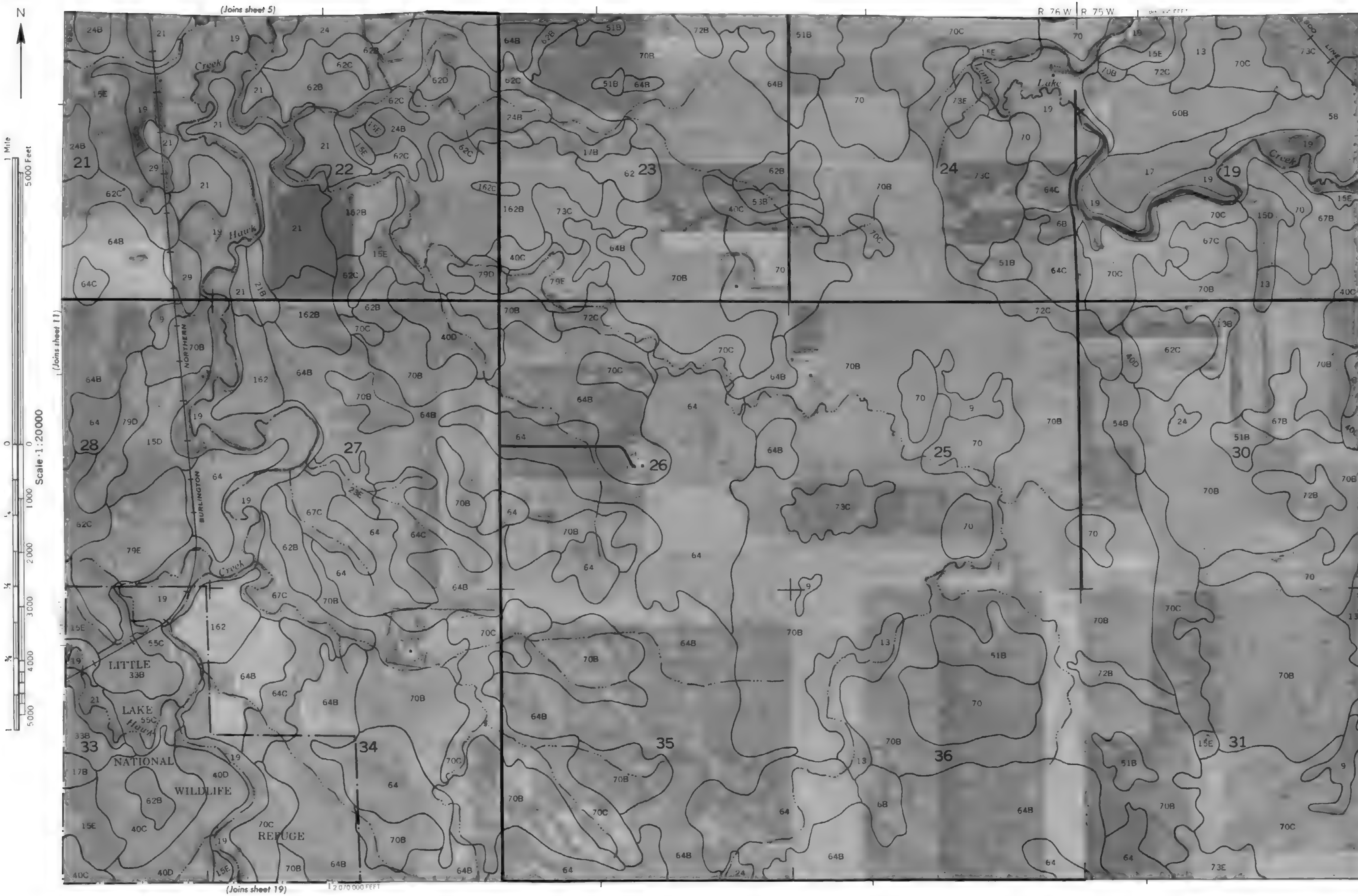
R. 74 W.
(Joins sheet 14)
T. 136 N.
LOGAN COUNTY
Kintyre
(Joins sheet 22)


9
N
R 78 W
T 136 N
(Joins sheet 2)
(Joins sheet 10)
(Joins sheet 16)
(Joins inset, sheet 107)
1804
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
Badger Creek
1 Mile
5000 Feet
Scale 1:20000

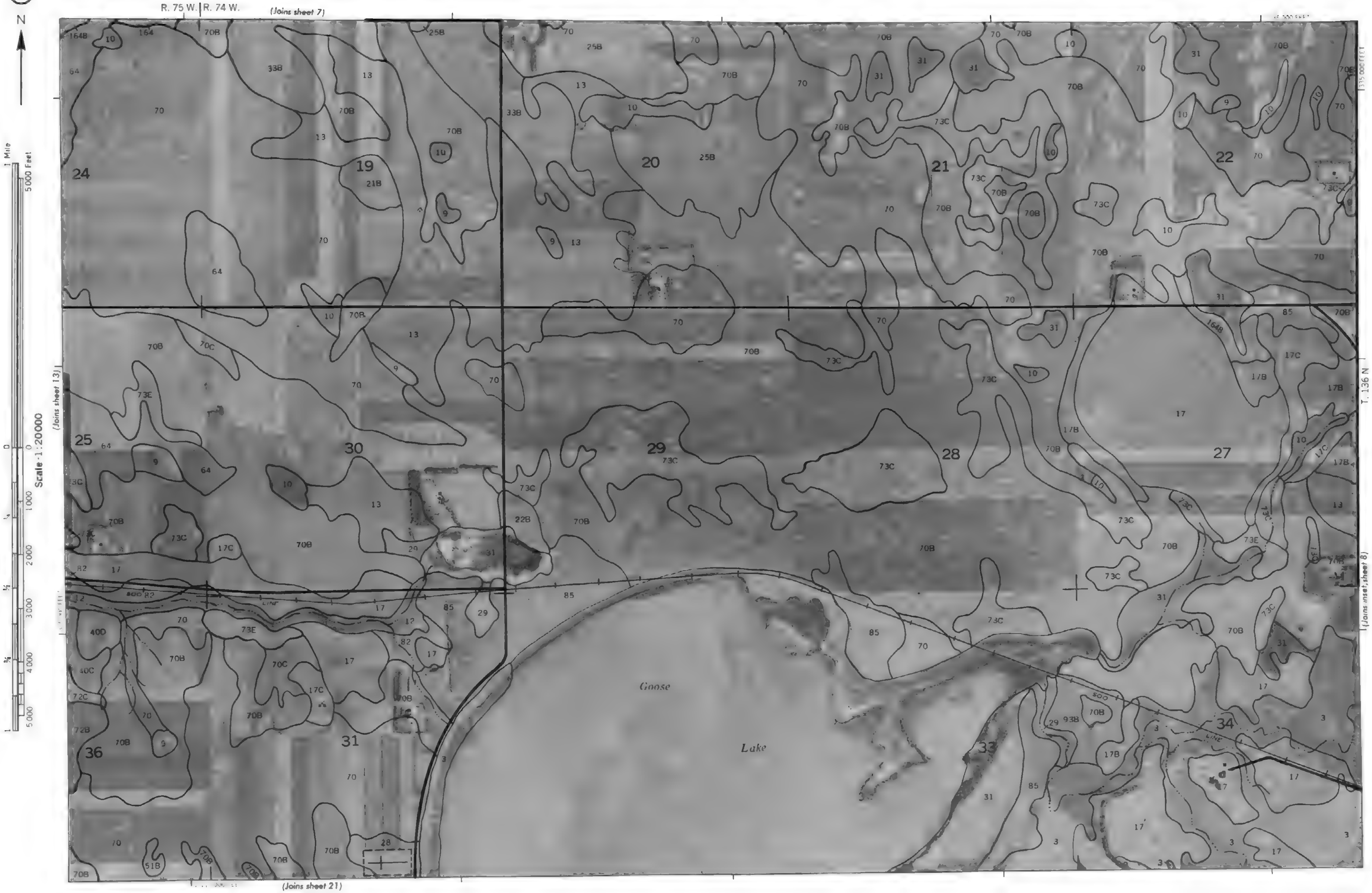

N
R. 78 W.
R. 77 W.
(Joins sheet 3)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 17)
T. 136 N.
Scale 1:20000
1 Mile
5000 Feet
2 020 000 FEET
Badger
Creek
Badger
Creek
19
20
21
22
24
25
30
29
28
27
36
31
32
33
34

EMMONS COUNTY, NORTH DAKOTA — SHEET NUMBER 11



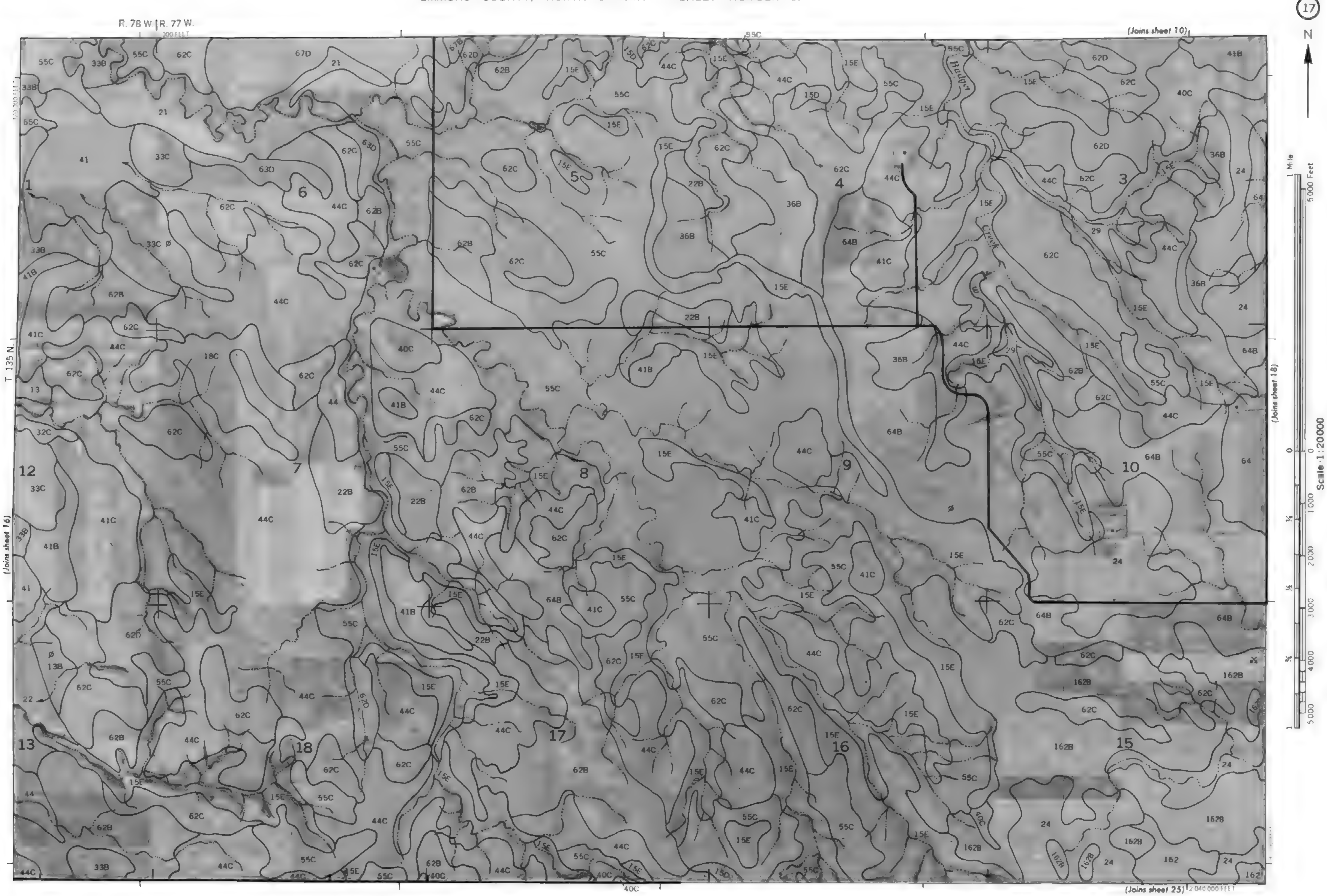

N
(Joins sheet 5)
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 19)
R. 76 W. | R. 75 W.
T. 136 N.
1 Mile
5000 Feet
Scale 1:20000
Hawk Creek
Long Lake Creek
NORTHERN
BURLINGTON
SOO LINE
LITTLE LAKE
Hawk
NATIONAL WILDLIFE REFUGE
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
2 070 000 FEET

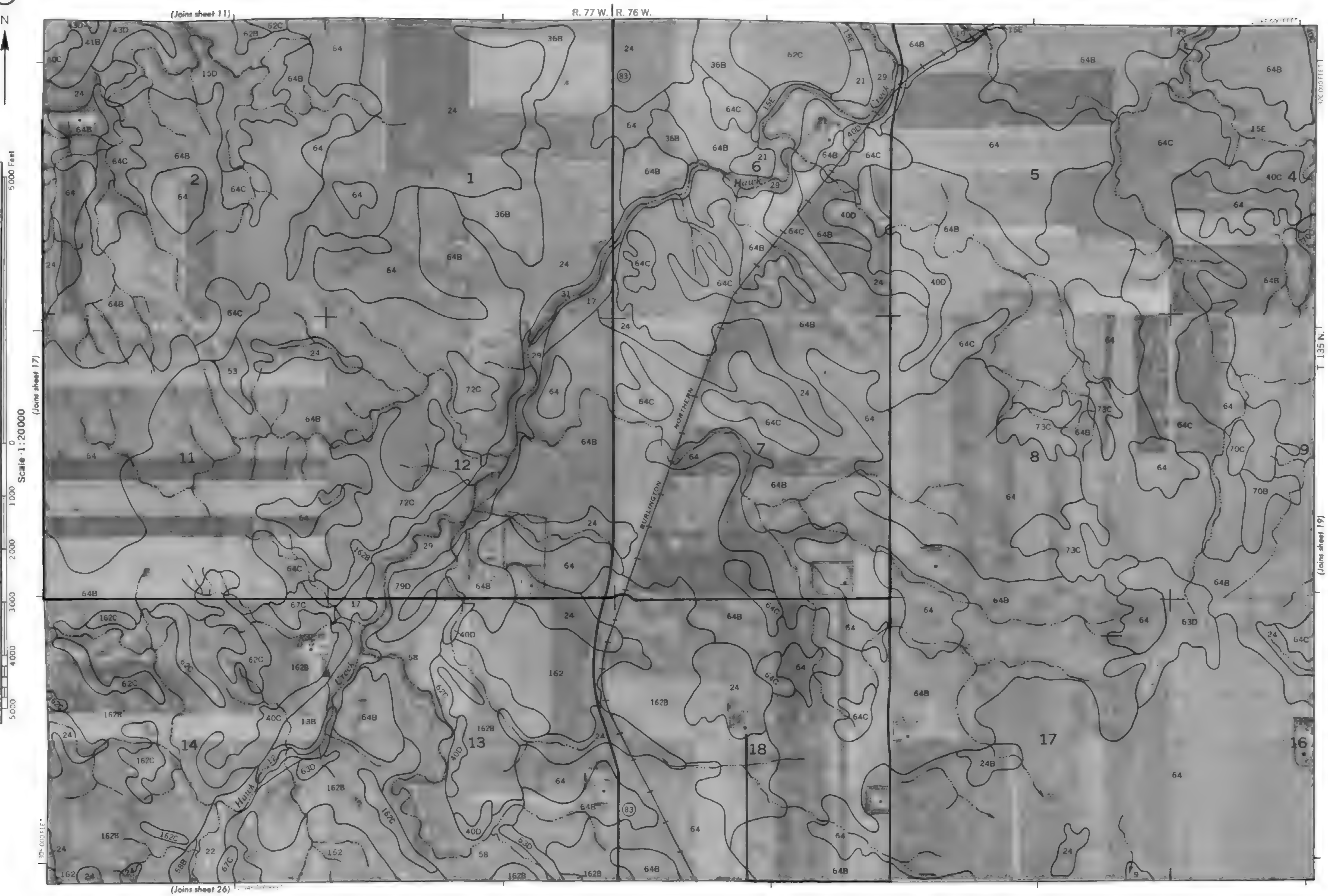

R. 75 W
T 136 N.
(Joins sheet 6)
(Joins sheet 14)
(Joins sheet 20)
(Joins sheet 12)
Braddock
Long Lake Creek
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
N
1 Mile
5000 Feet
Scale 1:20000

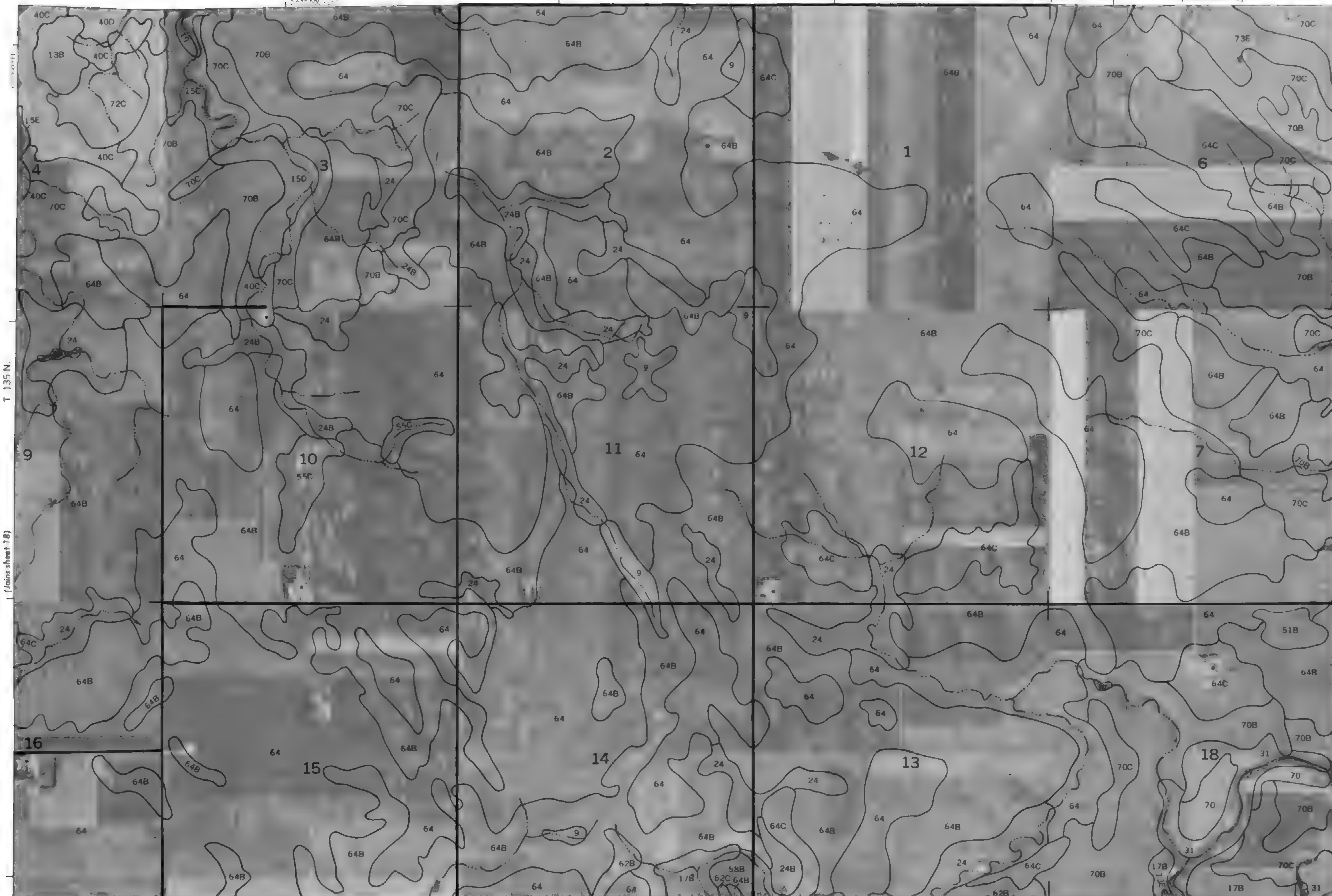

N
R. 75 W.
R. 74 W.
(Joins sheet 7)
(Joins sheet 13)
(Joins inset, sheet 8)
(Joins sheet 21)
T. 136 N.
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
24
19
20
21
22
25
30
29
28
27
36
31
33
34
Goose
Lake

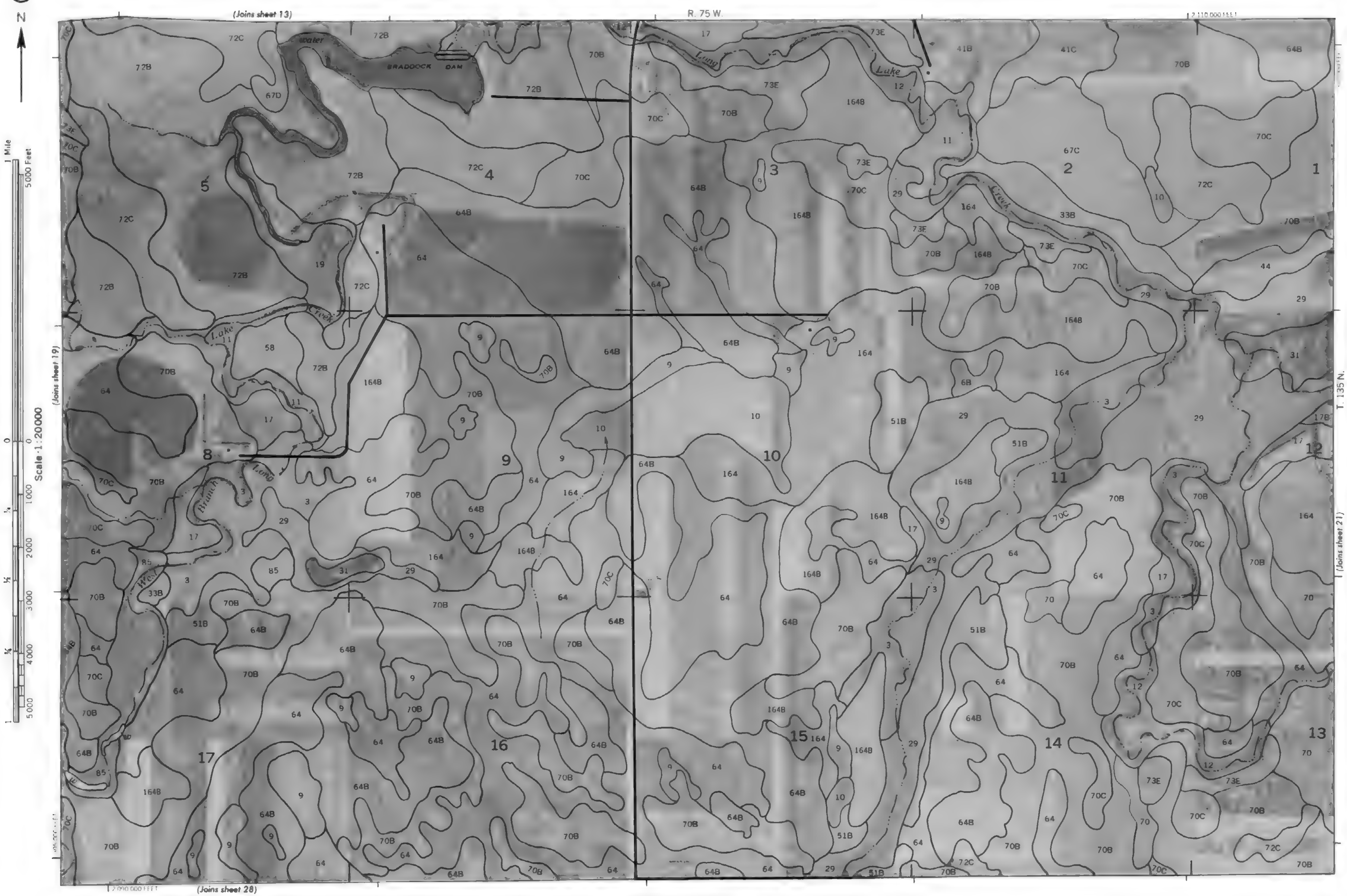

15
N
R. 79 W. | R. 78 W.
(Joins inset, sheet 107)
LAKE
OAHE
T. 135 N.
MORTON COUNTY
INDEFINITE
BOUNDARY
(Joins sheet 16)
(Joins sheet 23)
1 990 000 FEET
1804
Badger Creek
6
7
18
19
24
24B
15E
36C
21
35E
162C
62B
41C
44
44C
15D
32C
32B
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000

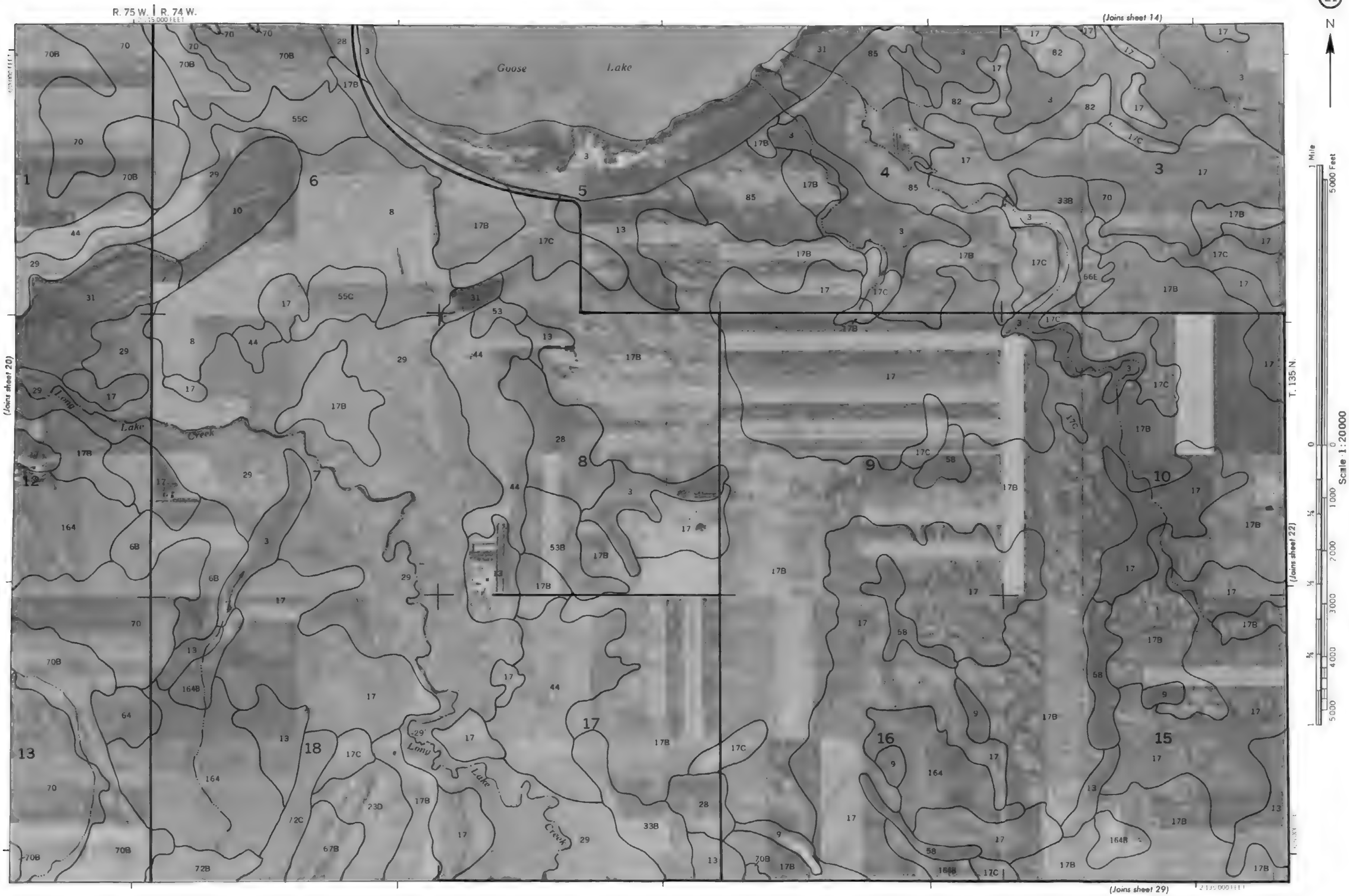

N
(Joins sheet 9)
R. 78 W.
T. 135 N.
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 24)
Scale 1:20000
1 Mile
5000 Feet
Badger Creek

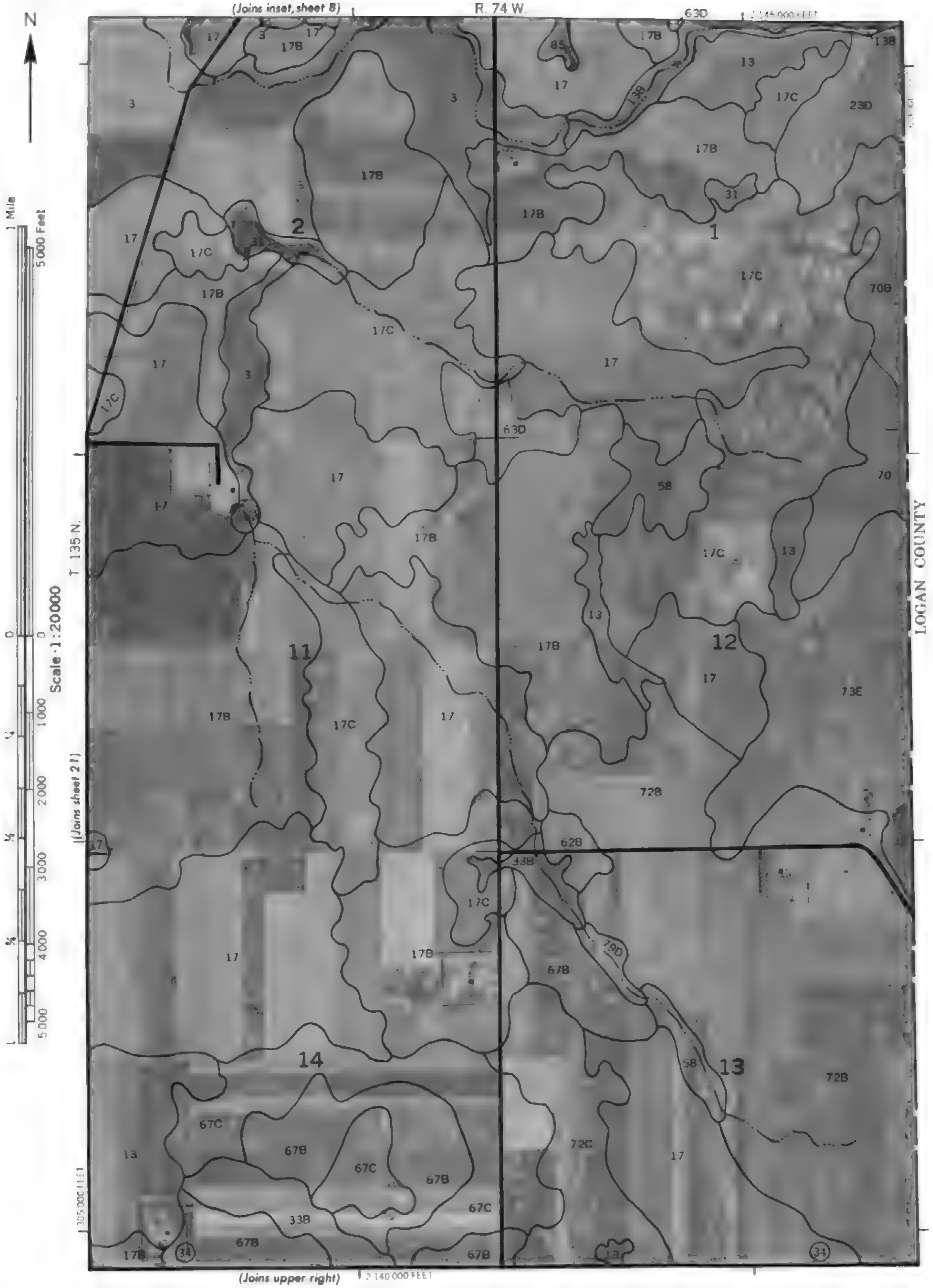

17
R. 78 W. | R. 77 W.
(Joins sheet 10)
T. 135 N.
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 25)
Badger Creek
N
1 Mile
5000 Feet
Scale 1:20000

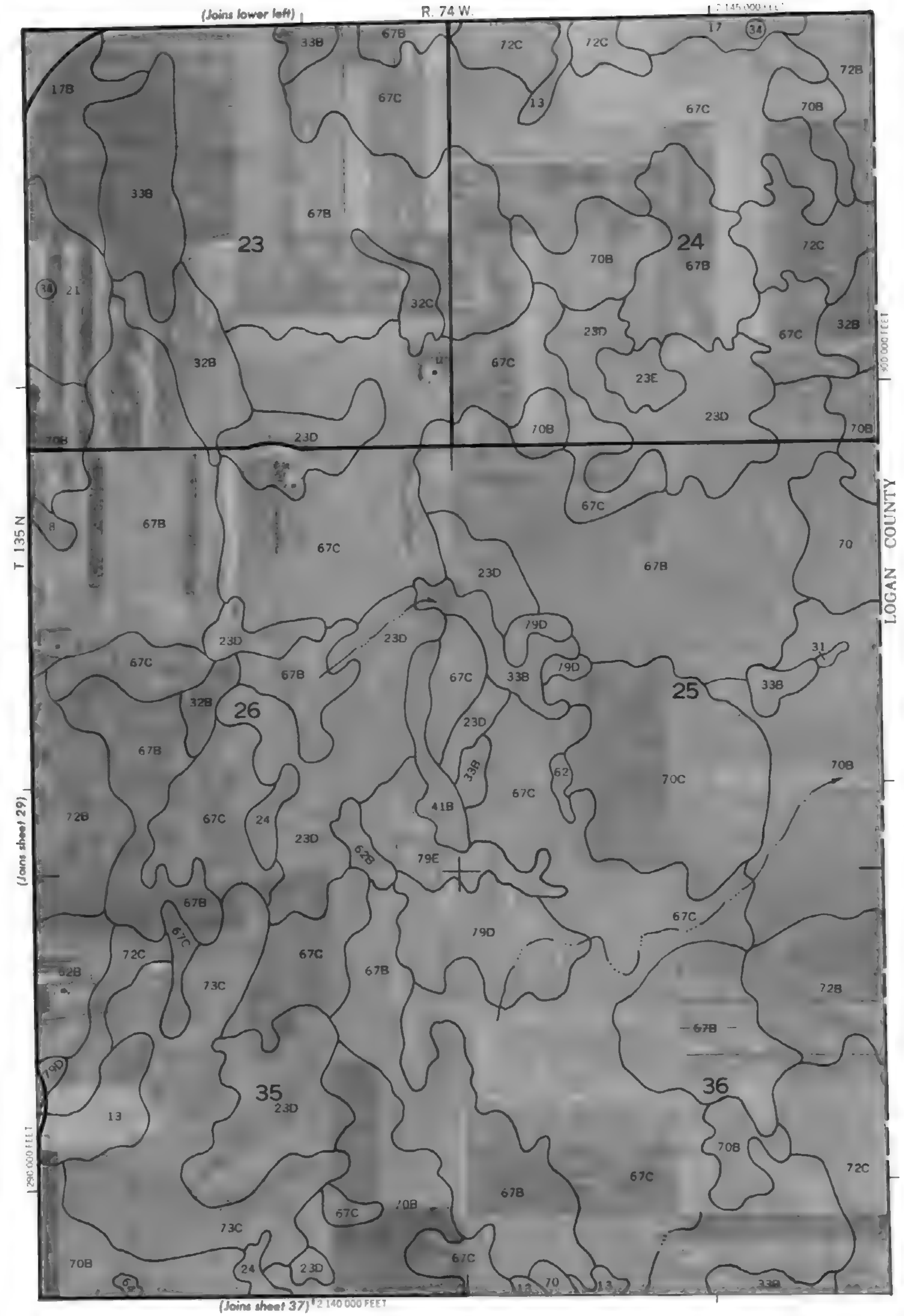

N
(Joins sheet 11)
R. 77 W.
R. 76 W.
T. 135 N.
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 26)
1 Mile
5000 Feet
Scale 1:20000
Hawk Creek
BURLINGTON NORTHERN
83

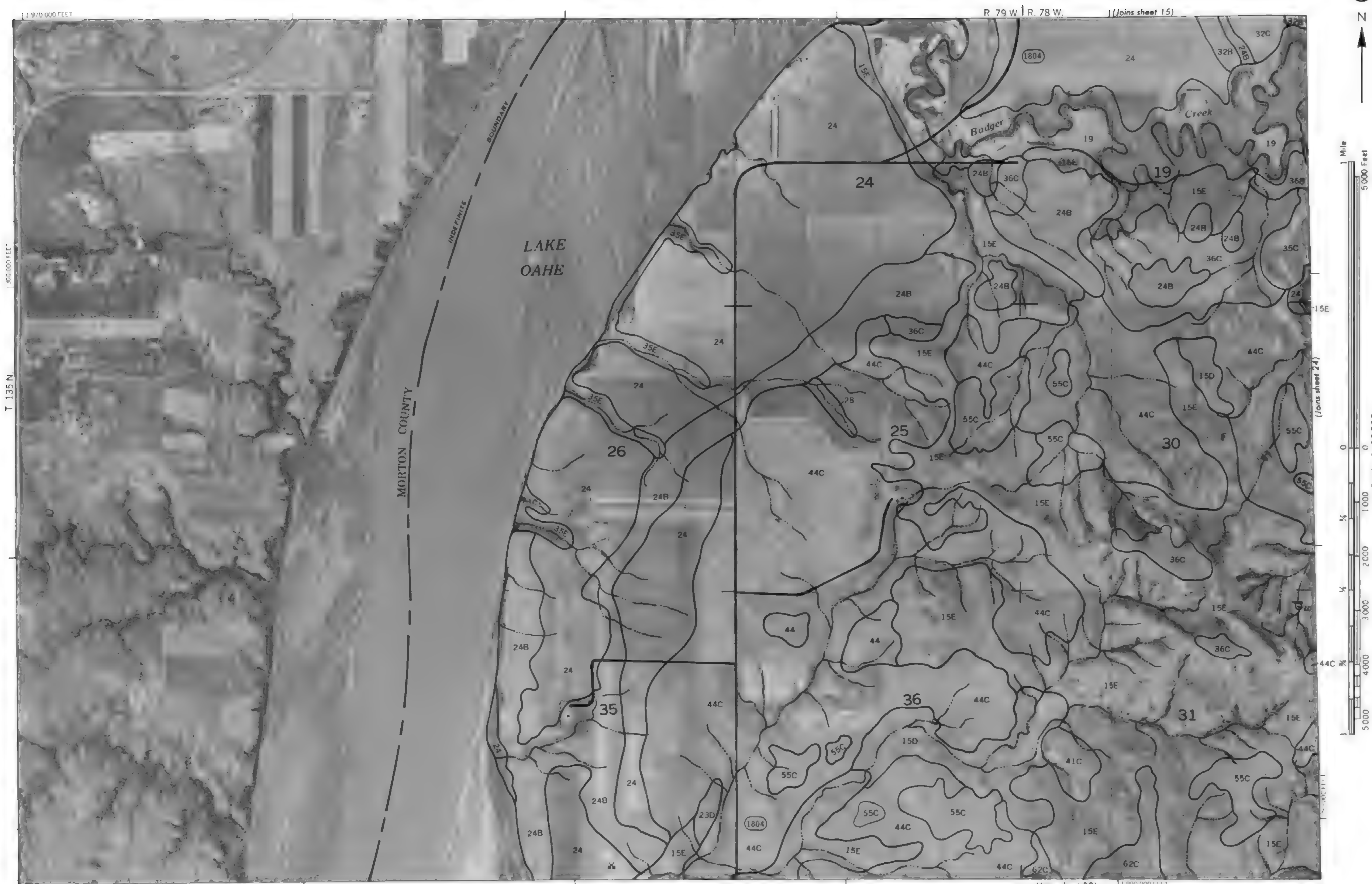

R. 76 W. | R. 75 W.
(Joins sheet 12)
(Joins sheet 20)
(Joins sheet 27)
(Joins sheet 18)
T. 135 N.
N
2 085 000 FEET
Scale 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1000
2000
3000
4000
5000

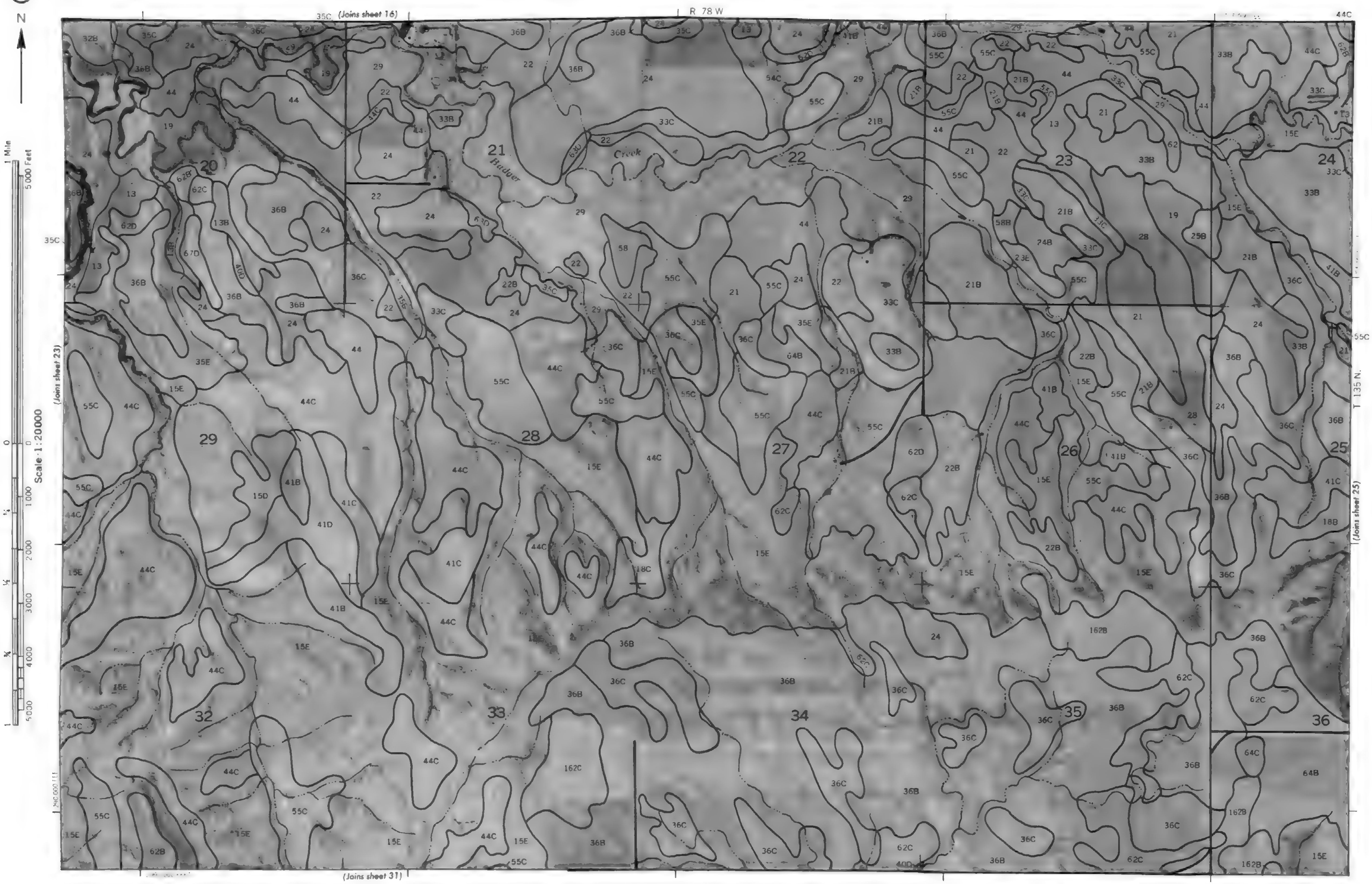

N
(Joins sheet 13)
R. 75 W.
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 28)
T. 135 N.
BRADOCK DAM
Long Lake Creek
Long Lake Creek
West Branch Long Lake Creek
Scale 1:20000
1 Mile
5000 Feet
2 090 000 FEET
2 110 000 FEET

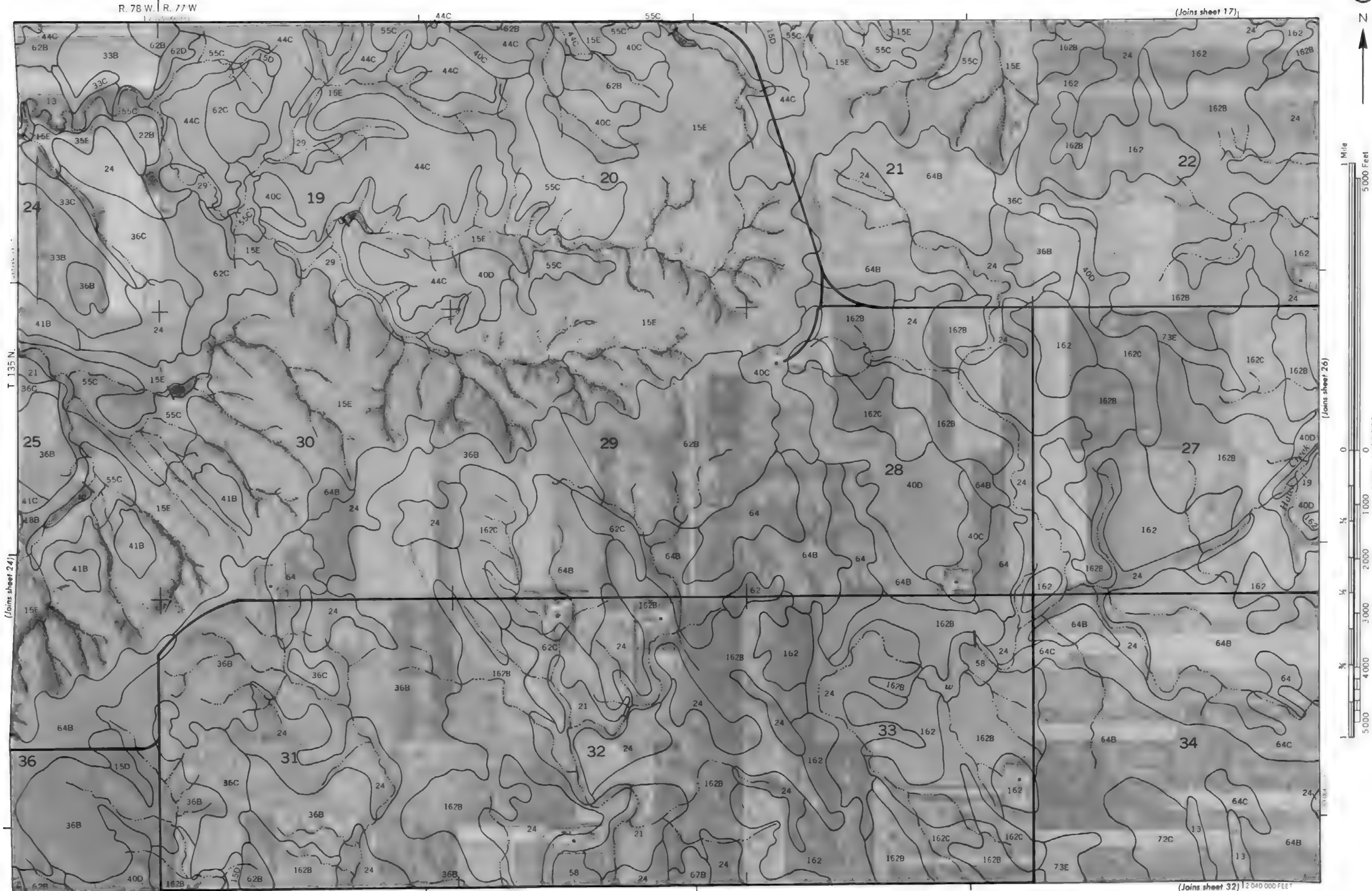

21
N
R. 75 W.
R. 74 W.
(Joins sheet 14)
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 29)
T. 135 N.
Goose Lake
Long Lake Creek
Scale 1:20000
1 Mile
5000 Feet
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18

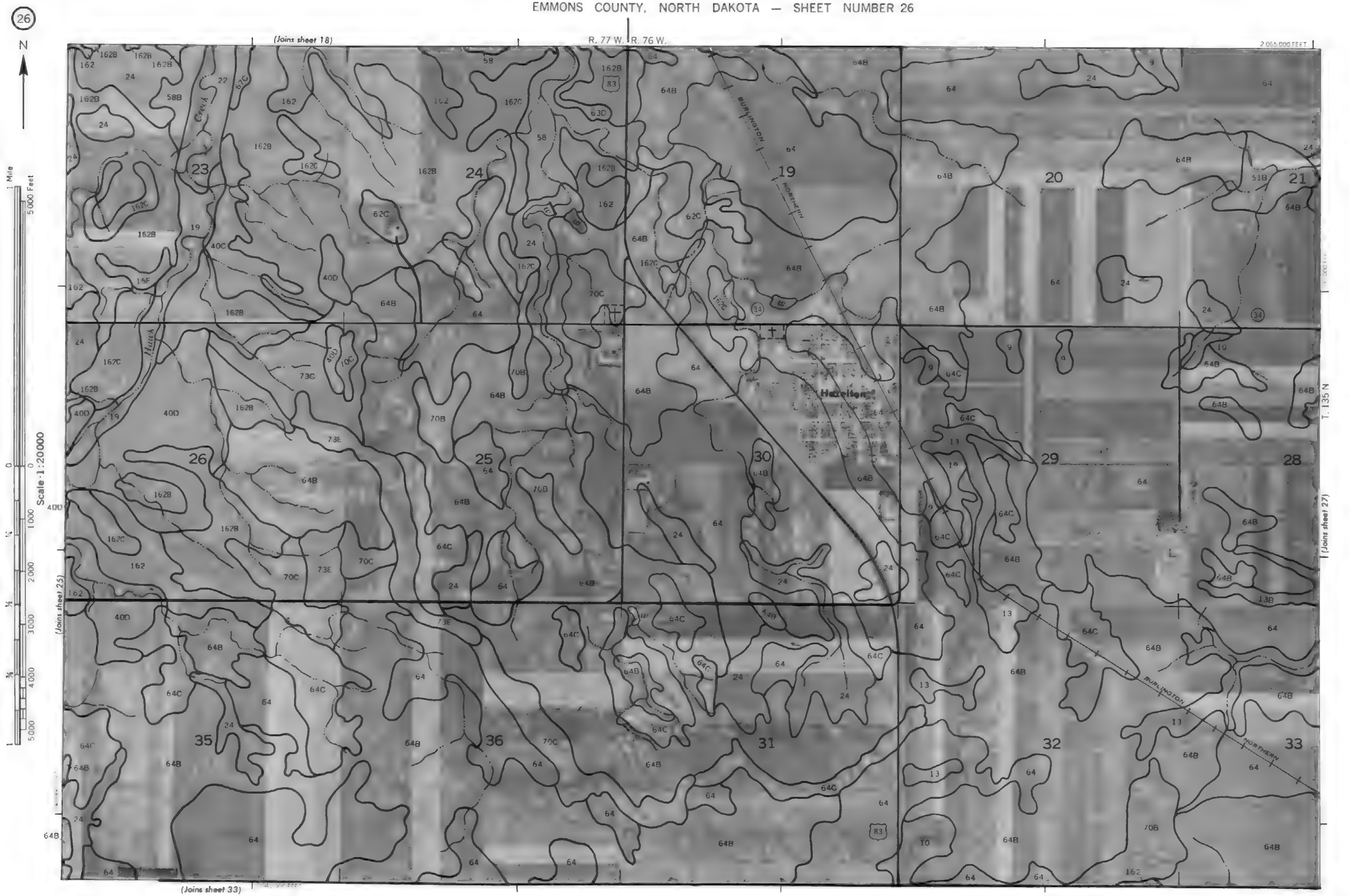

N
(Joins inset, sheet 8)
R. 74 W.
2 145 000 FEET
1 Mile
5000 Feet
Scale 1:20000
T 135 N.
(Joins sheet 21)
LOGAN COUNTY
305 000 FEET
(Joins upper right)
2 140 000 FEET
2
1
11
12
14
13

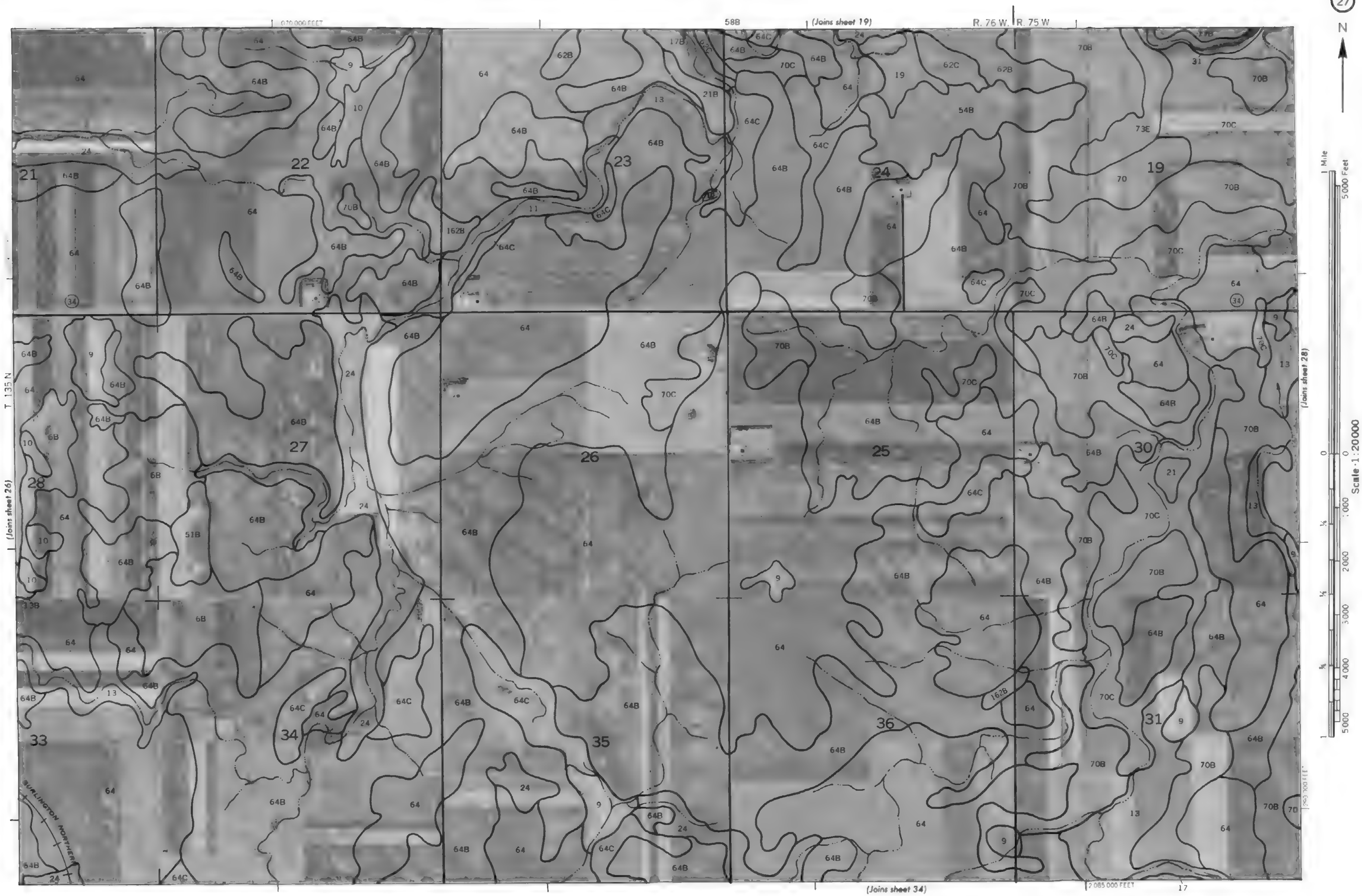

(Joins lower left)
R. 74 W.
2 145 000 FEET
T 135 N.
(Joins sheet 29)
LOGAN COUNTY
300 000 FEET
290 000 FEET
(Joins sheet 37)
2 140 000 FEET
23
24
26
25
35
36

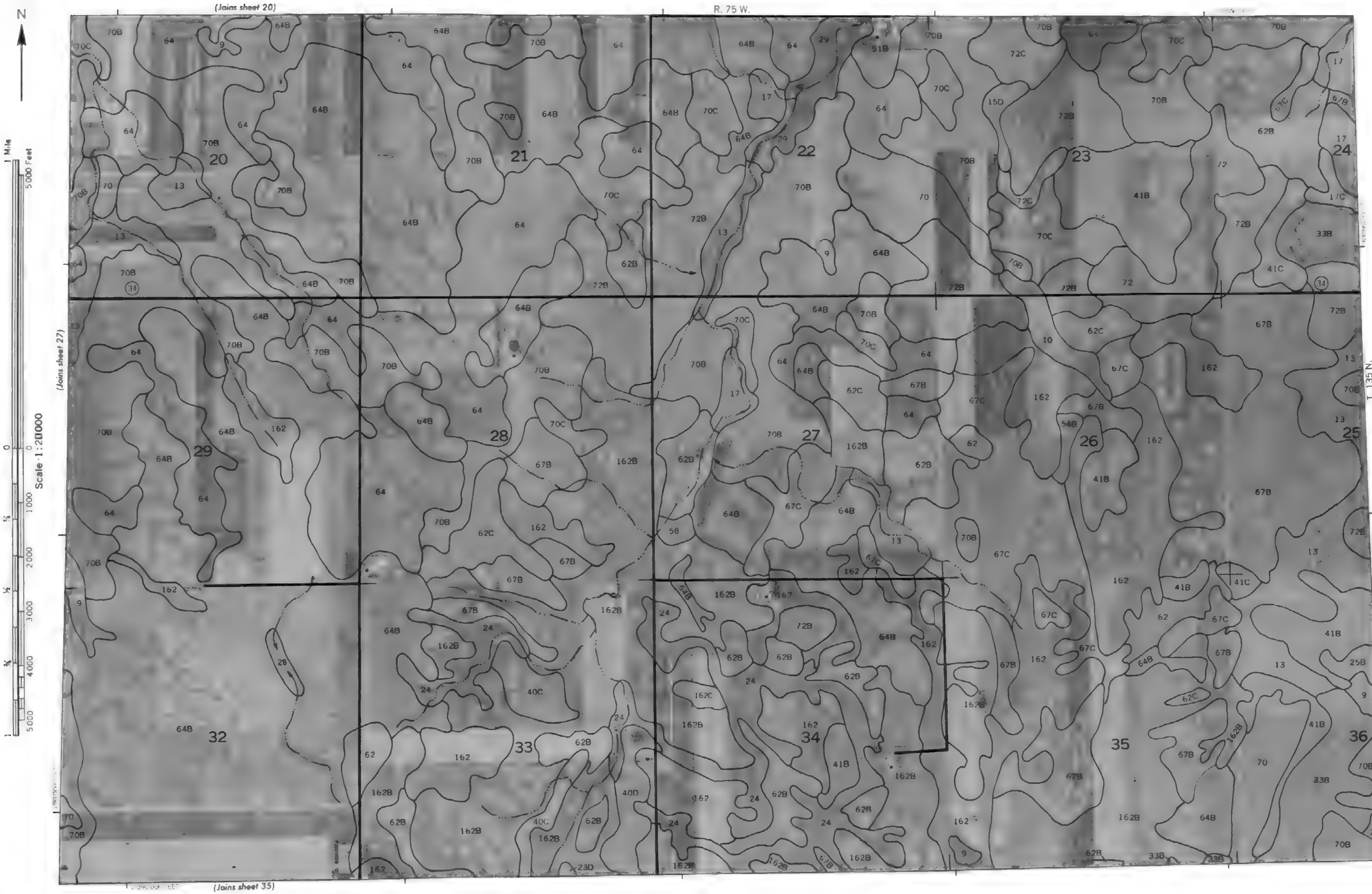

23
N
R. 79 W. | R. 78 W.
(Joins sheet 15)
(Joins sheet 24)
(Joins sheet 30)
1 970 000 FEET
1 990 000 FEET
T 135 N.
LAKE OAHE
MORTON COUNTY
INDEFINITE BOUNDARY
Badger
Creek
1804
24
25
26
30
31
35
36
19
15E
15D
23D
24
24B
28
32B
32C
35C
35E
36C
41C
44
44C
55C
62C
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000

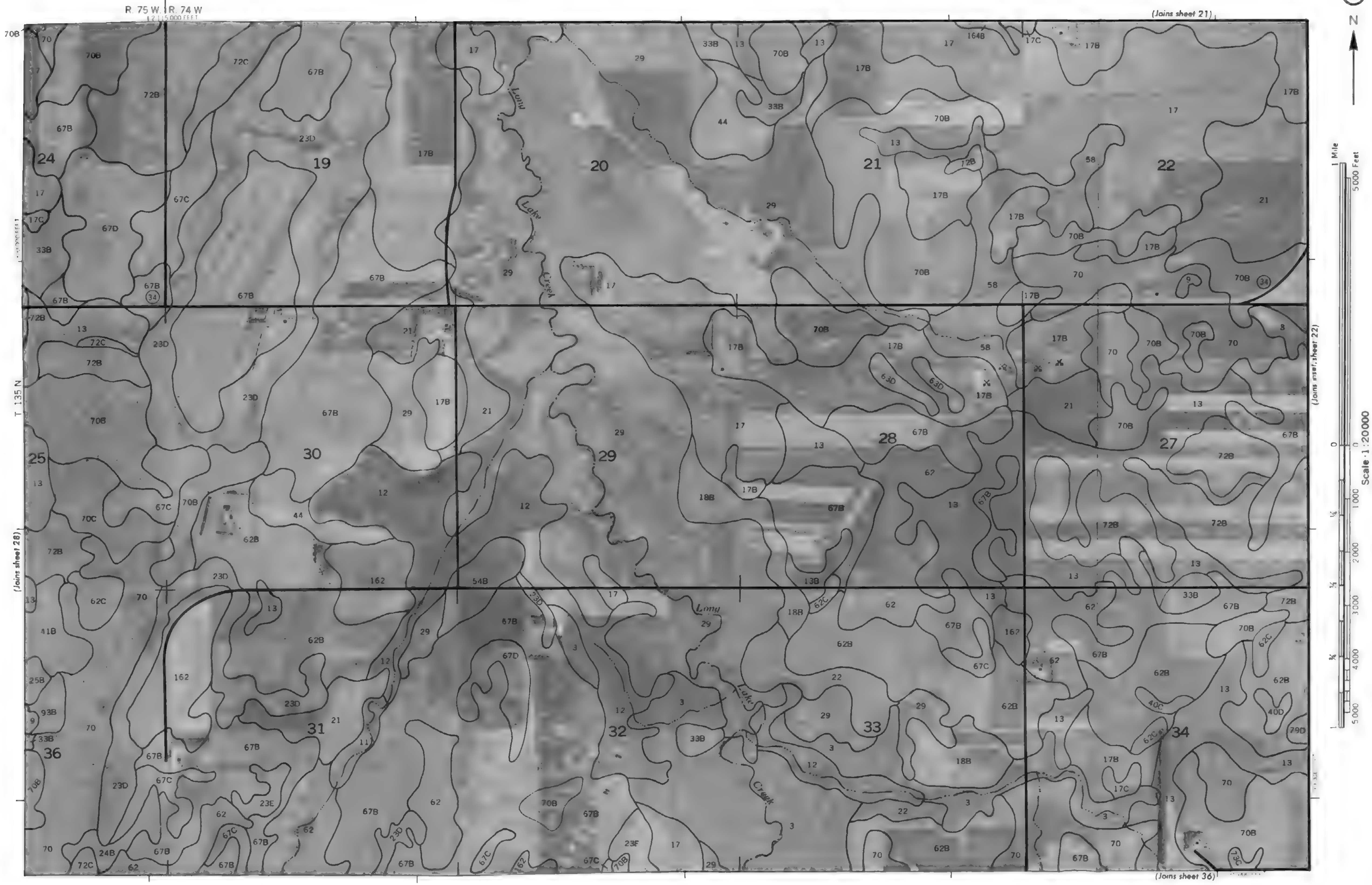

N
(Joins sheet 16)
R 78 W
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
T 135 N.
Scale 1:20000
1 Mile
5000 Feet
Badger
Creek
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

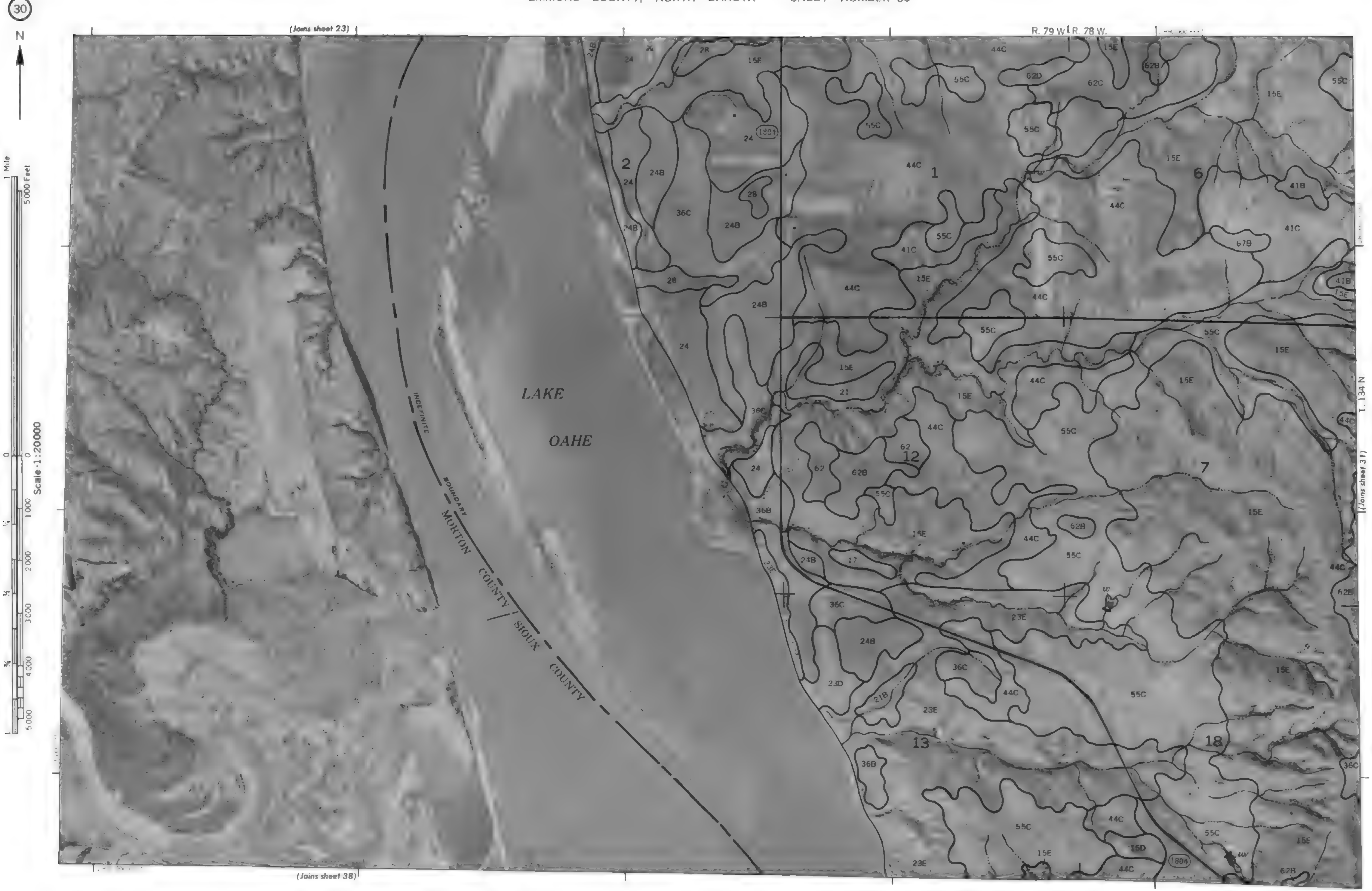

R. 78 W. | R. 77 W.
T. 135 N.
(Joins sheet 17)
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 24)
2 040 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
Hulls Creek

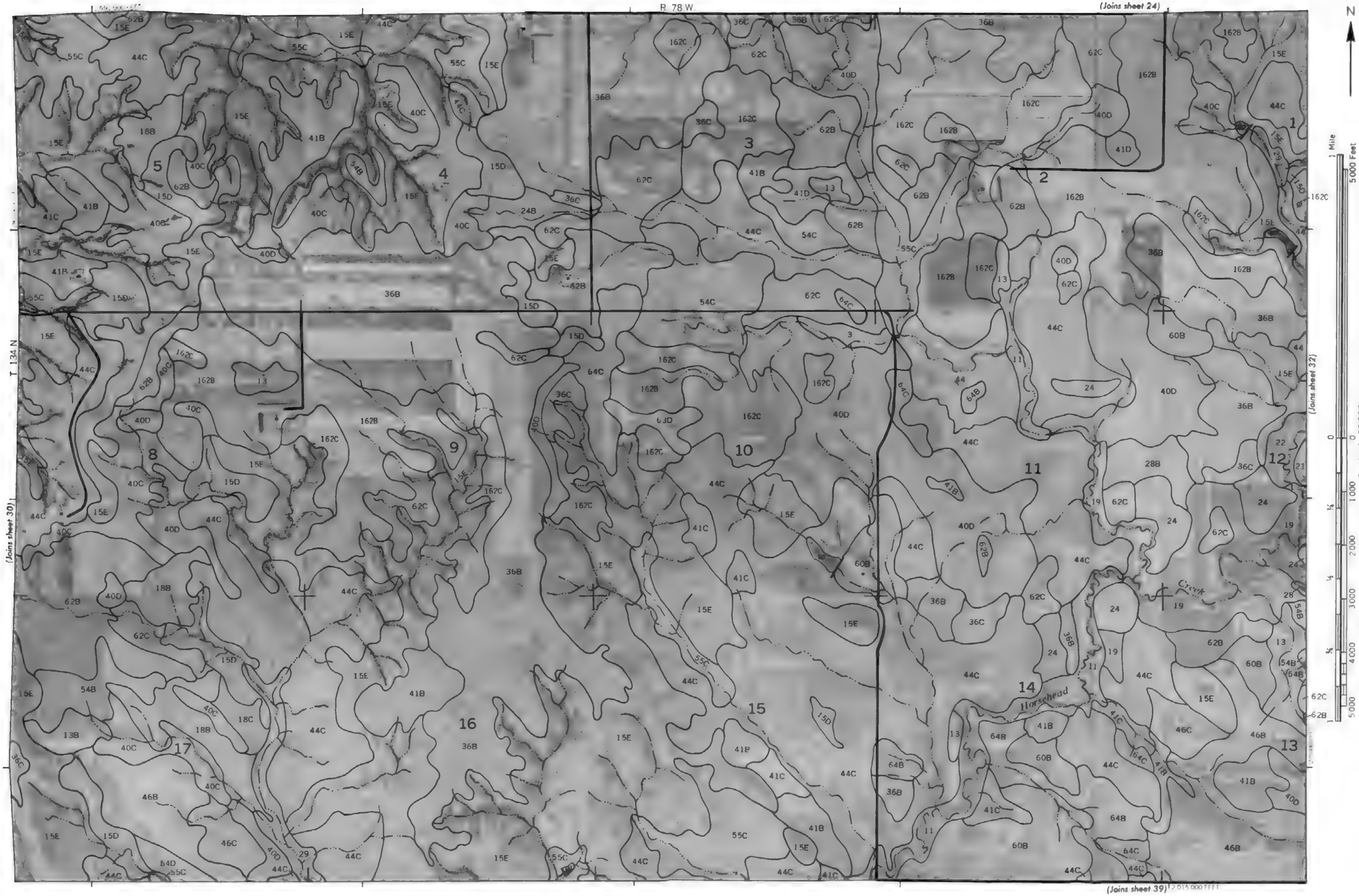

26
N
(Joins sheet 18)
R. 77 W. R. 76 W.
2 065 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 33)
T. 135 N.
Hazelton
BURLINGTON
NORTHERN
Hauk
Creek
83
34
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

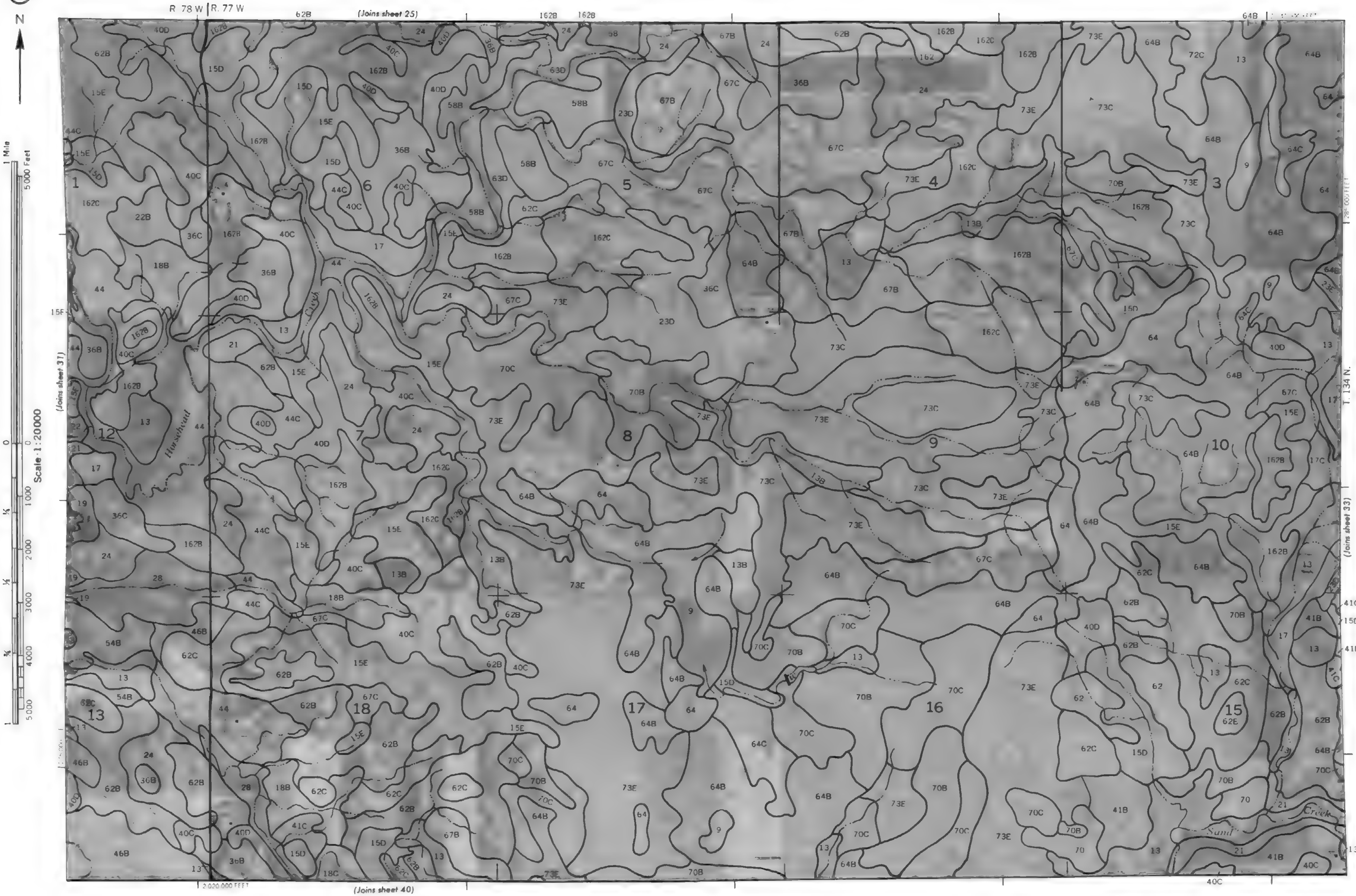

27
N
(Joins sheet 19)
R. 76 W.
R. 75 W.
T. 135 N.
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 34)
BURLINGTON NORTHERN
1 Mile
5000 Feet
Scale 1:20000
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31

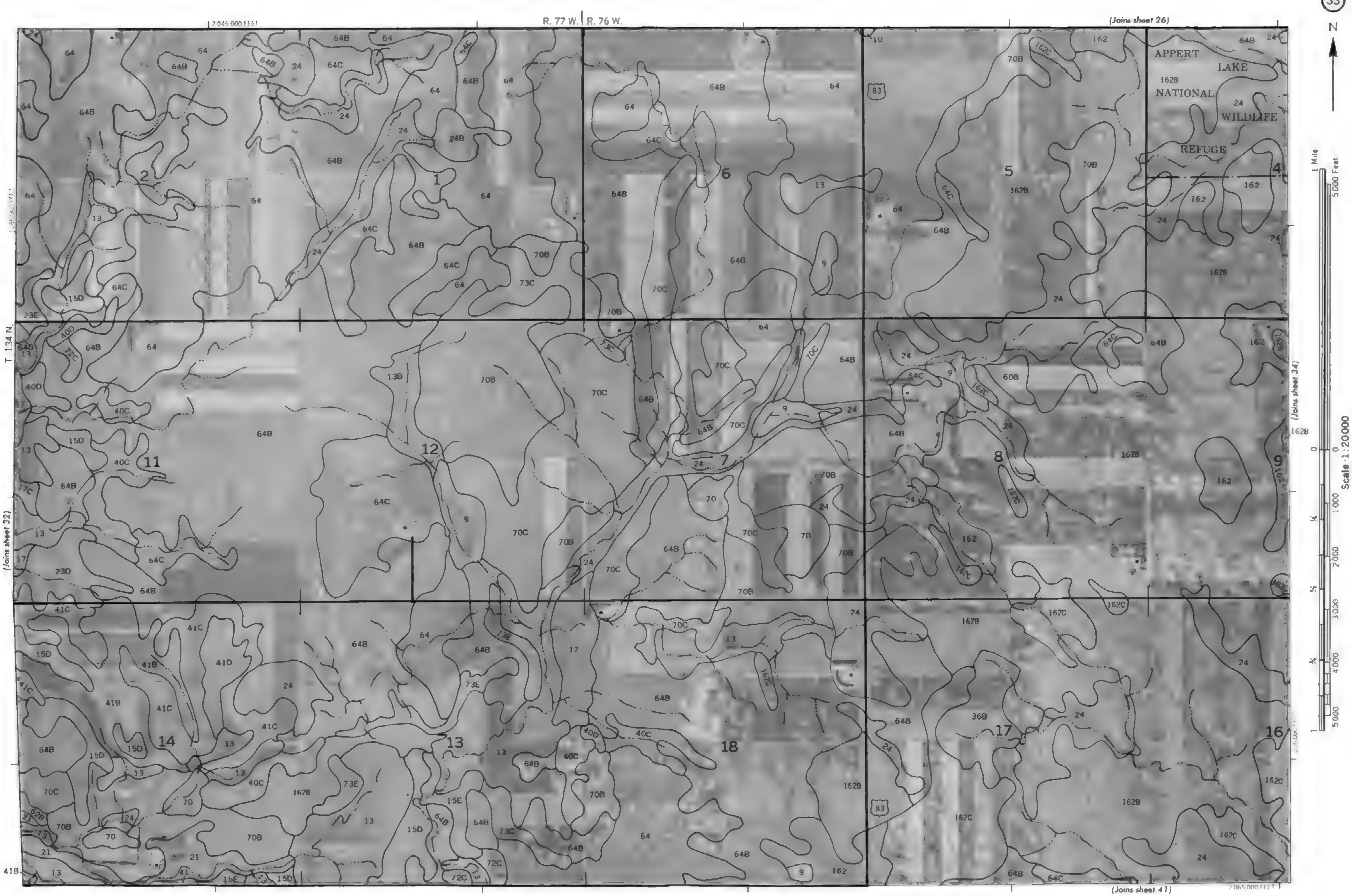

N
(Joins sheet 20)
R. 75 W.
(Joins sheet 27)
T. 135 N.
(Joins sheet 29)
(Joins sheet 35)
Scale 1:20000
1 Mile
5000 Feet
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

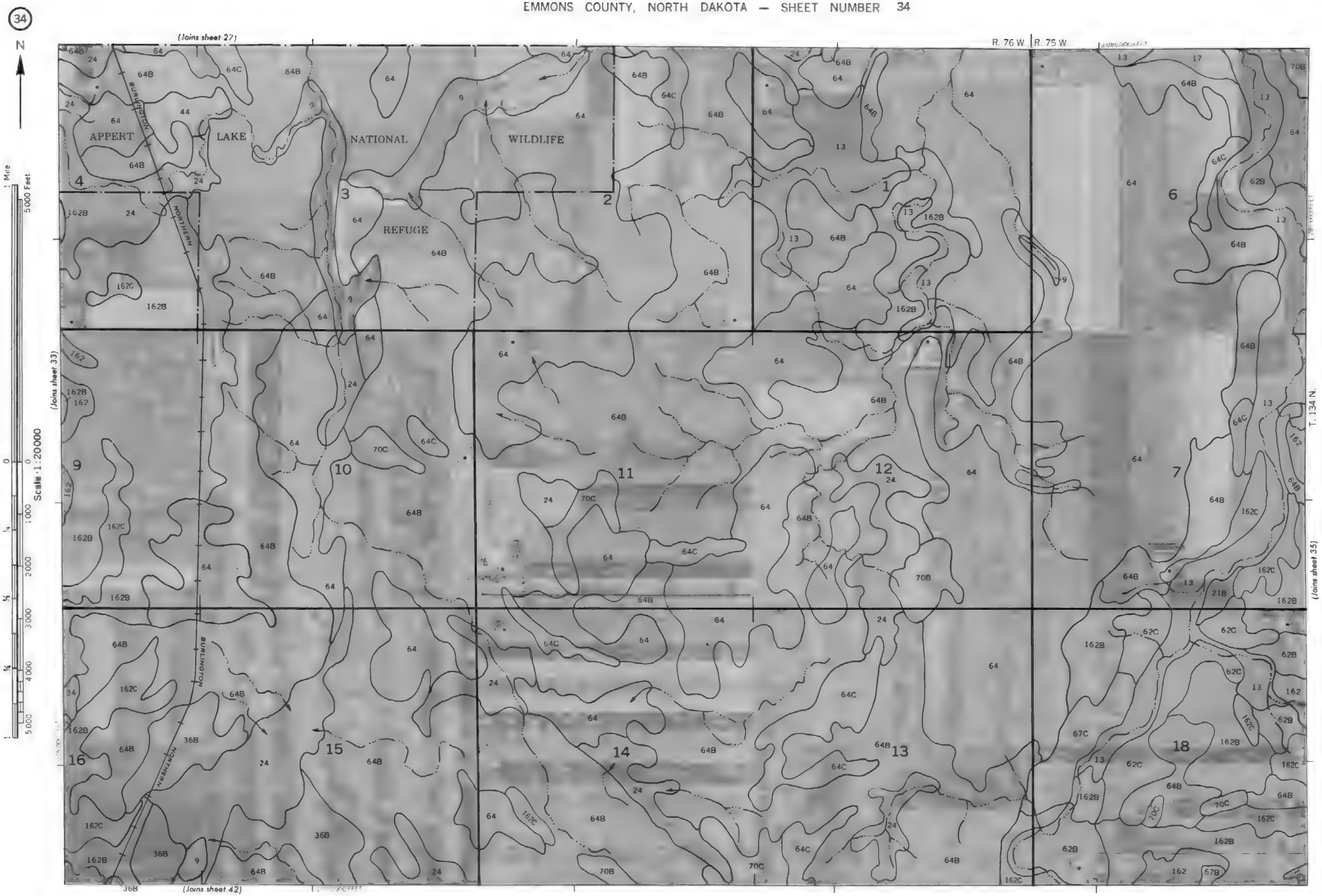

29
R. 75 W.
R. 74 W.
(Joins sheet 21)
(Joins inset, sheet 22)
(Joins sheet 28)
(Joins sheet 36)
T. 135 N.
N
1 Mile
5000 Feet
Scale 1:20000
Long Lake Creek
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36

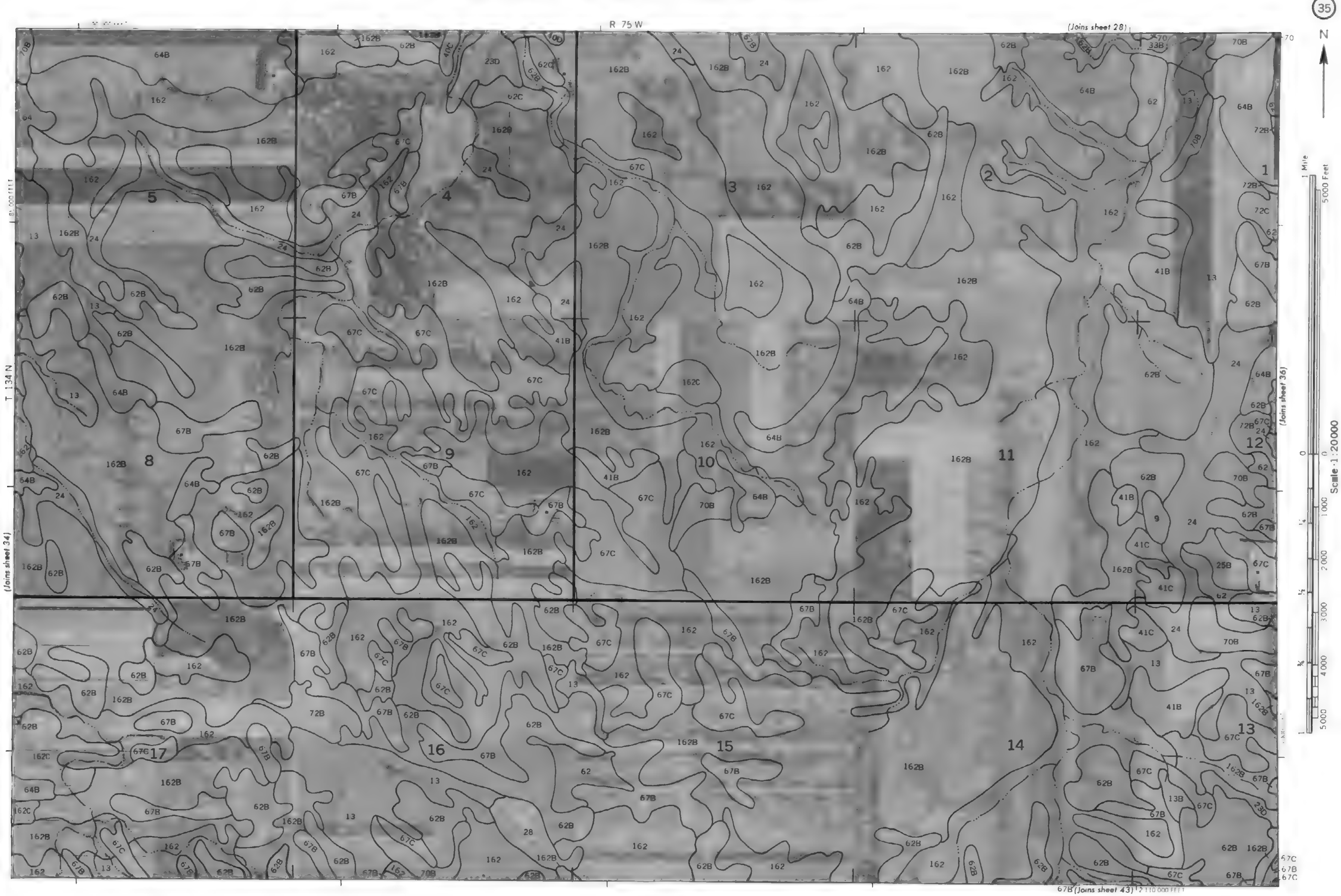

30
N
(Joins sheet 23)
R. 79 W.
R. 78 W.
LAKE
OAHE
INDEFINITE
BOUNDARY
MORTON
COUNTY
SIOUX
COUNTY
T. 134 N.
(Joins sheet 31)
(Joins sheet 38)
1 Mile
5000 Feet
Scale 1:20000
1804

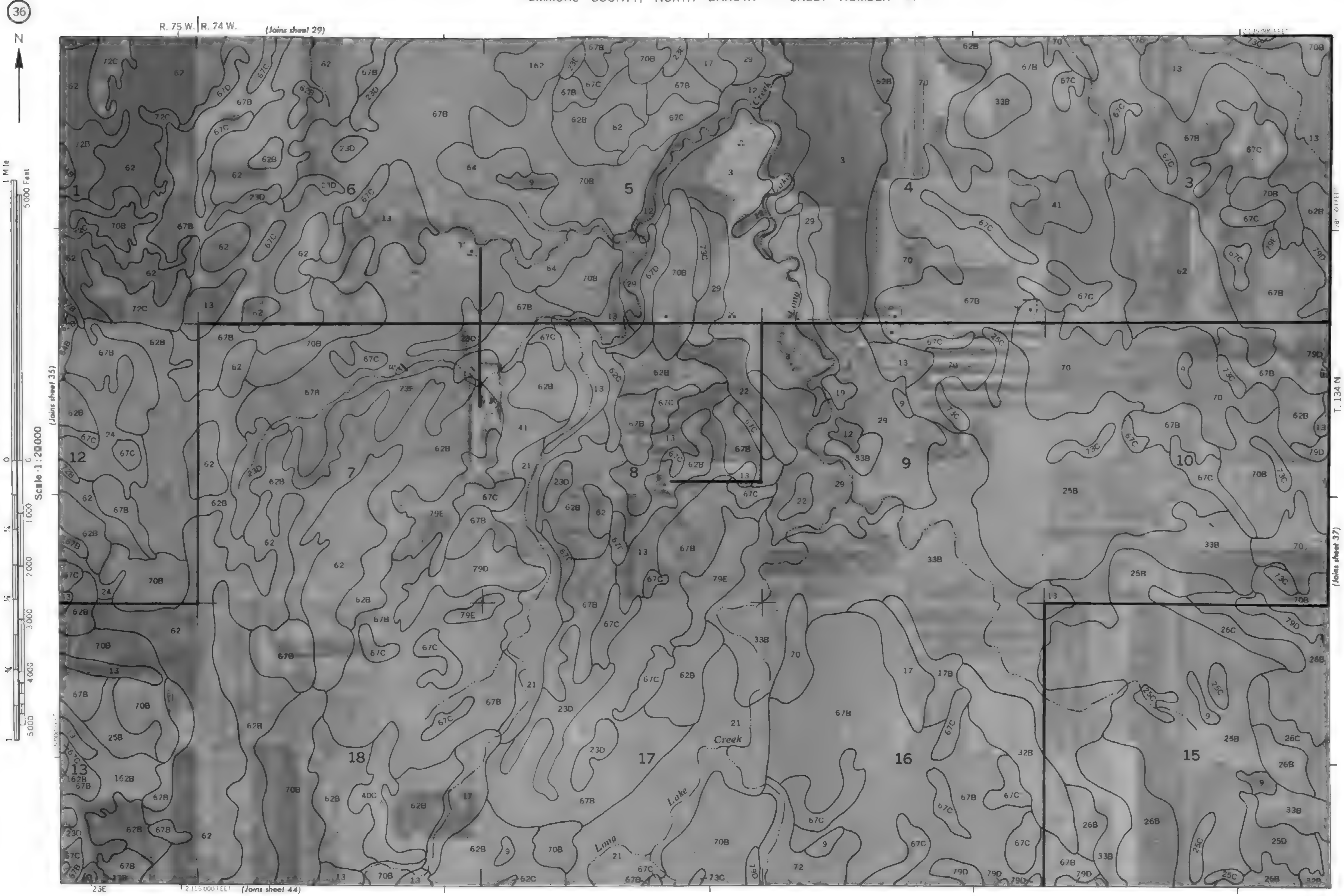

R. 78 W.
(Joins sheet 24)
N
T. 134 N.
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 39)
Horsehead
Creek
1 Mile
5000 Feet
Scale 1:20000

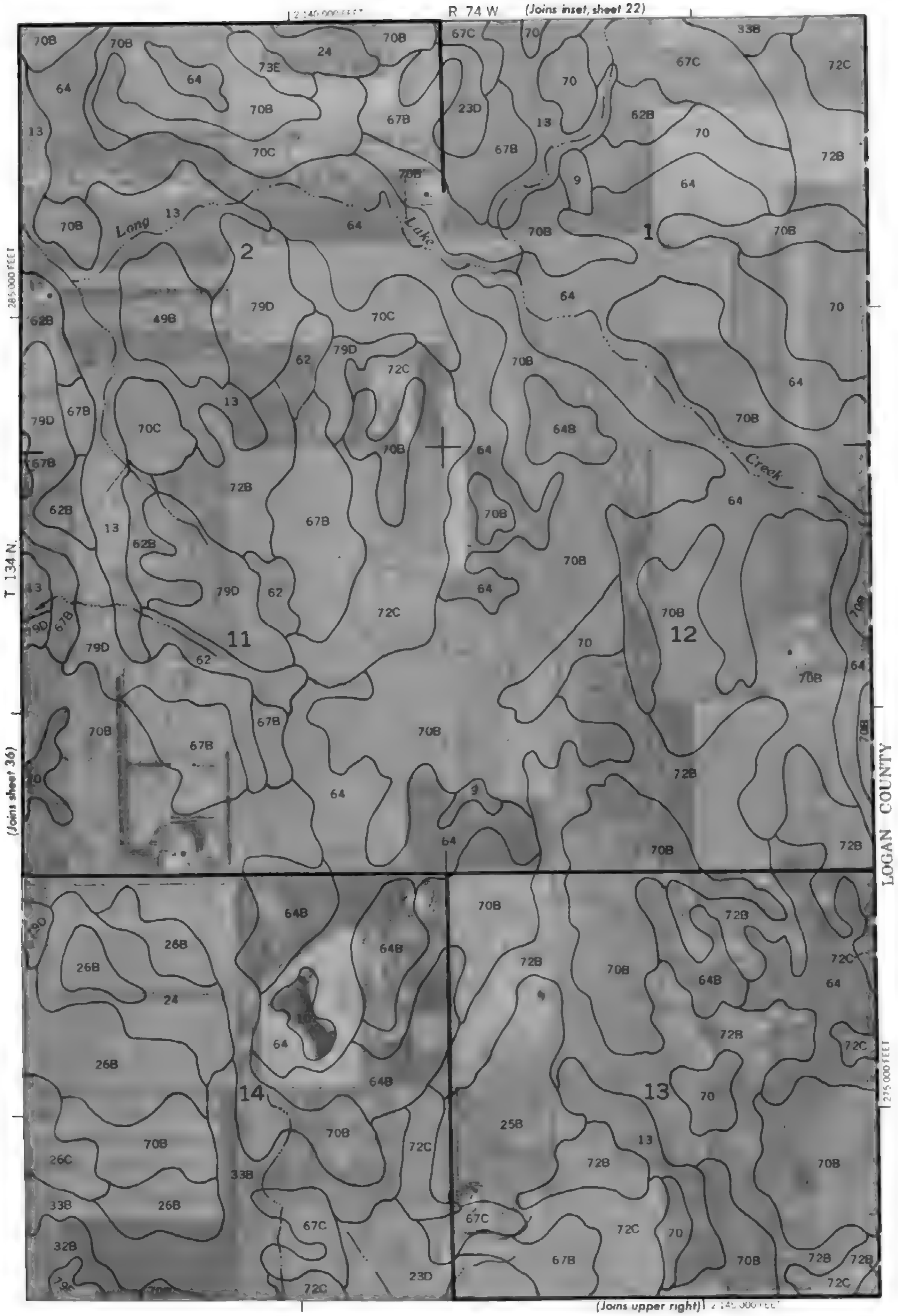

N
1 Mile
5000 Feet
Scale 1:20000
R. 78 W.
R. 77 W.
(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 40)
T. 134 N.
Horsehead
Creek
Sand
Creek
2 020 000 FEET

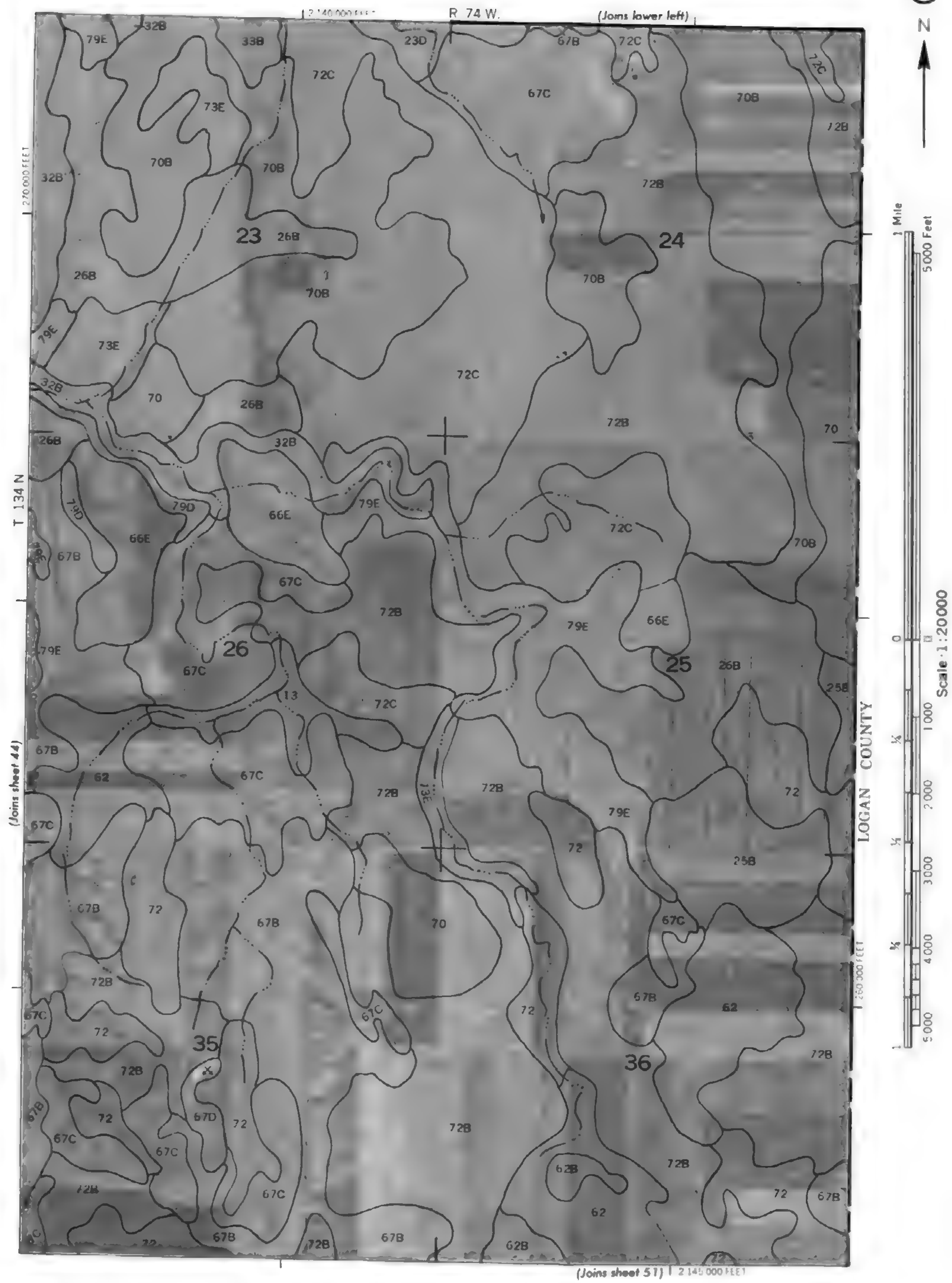

33
N
R. 77 W.
R. 76 W.
(Joins sheet 26)
2 045 000 FEET
APPERT LAKE NATIONAL WILDLIFE REFUGE
T. 134 N.
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 41)
2 065 000 FEET
83
1 Mile
5000 Feet
Scale 1:20000


34
N
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 42)
R. 76 W.
R. 75 W.
T. 134 N.
APPERT
LAKE
NATIONAL
WILDLIFE
REFUGE
BURLINGTON
NORTHERN
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18

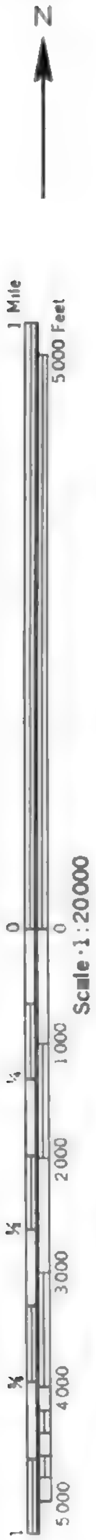

35
N
R 75 W
(Joins sheet 28)
T 134 N
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 43)
1 Mile
5000 Feet
Scale 1:20000

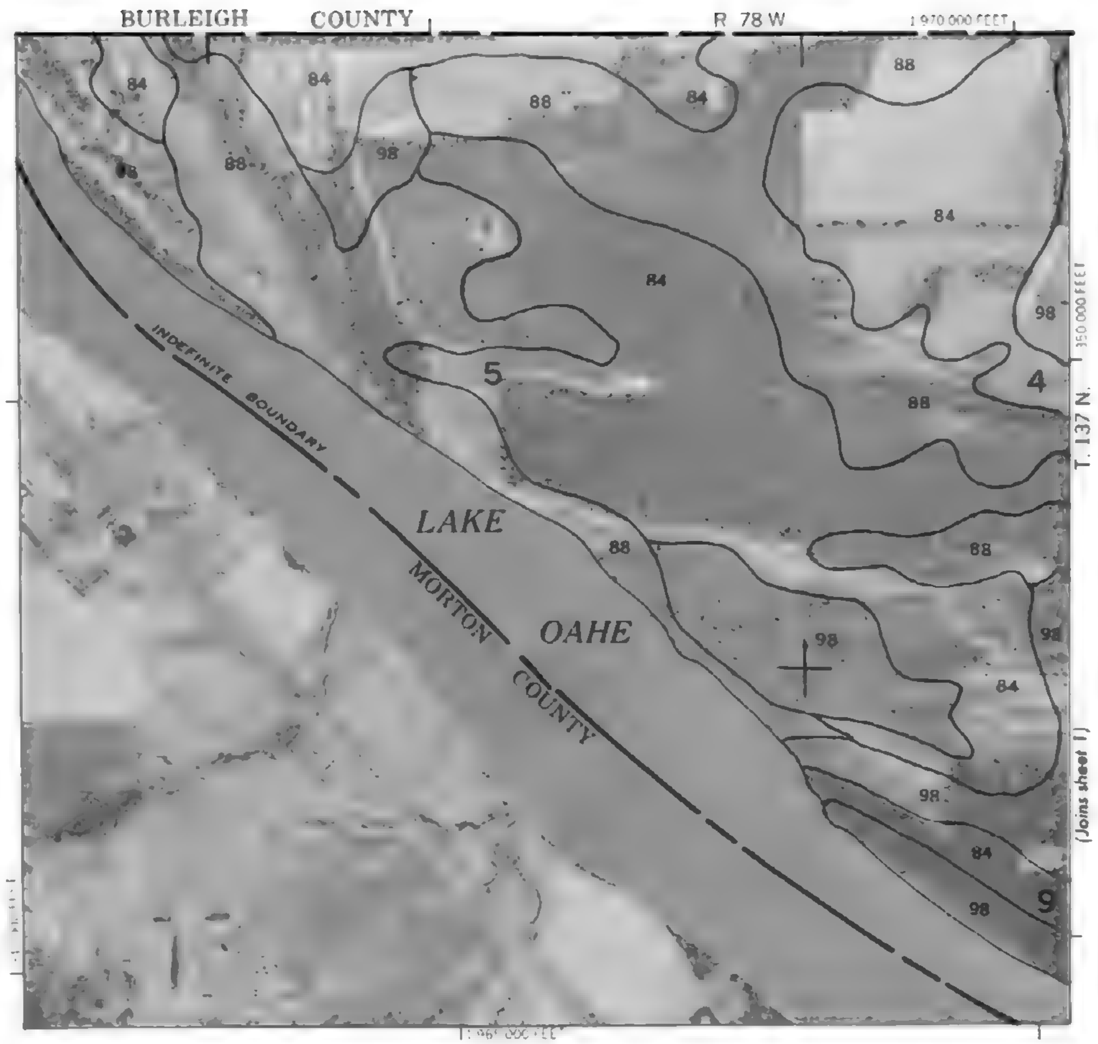

36
N
R. 75 W.
R. 74 W.
(Joins sheet 29)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 44)
T. 134 N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
2 115 000 FEET
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18
Long Creek
Long Lake Creek

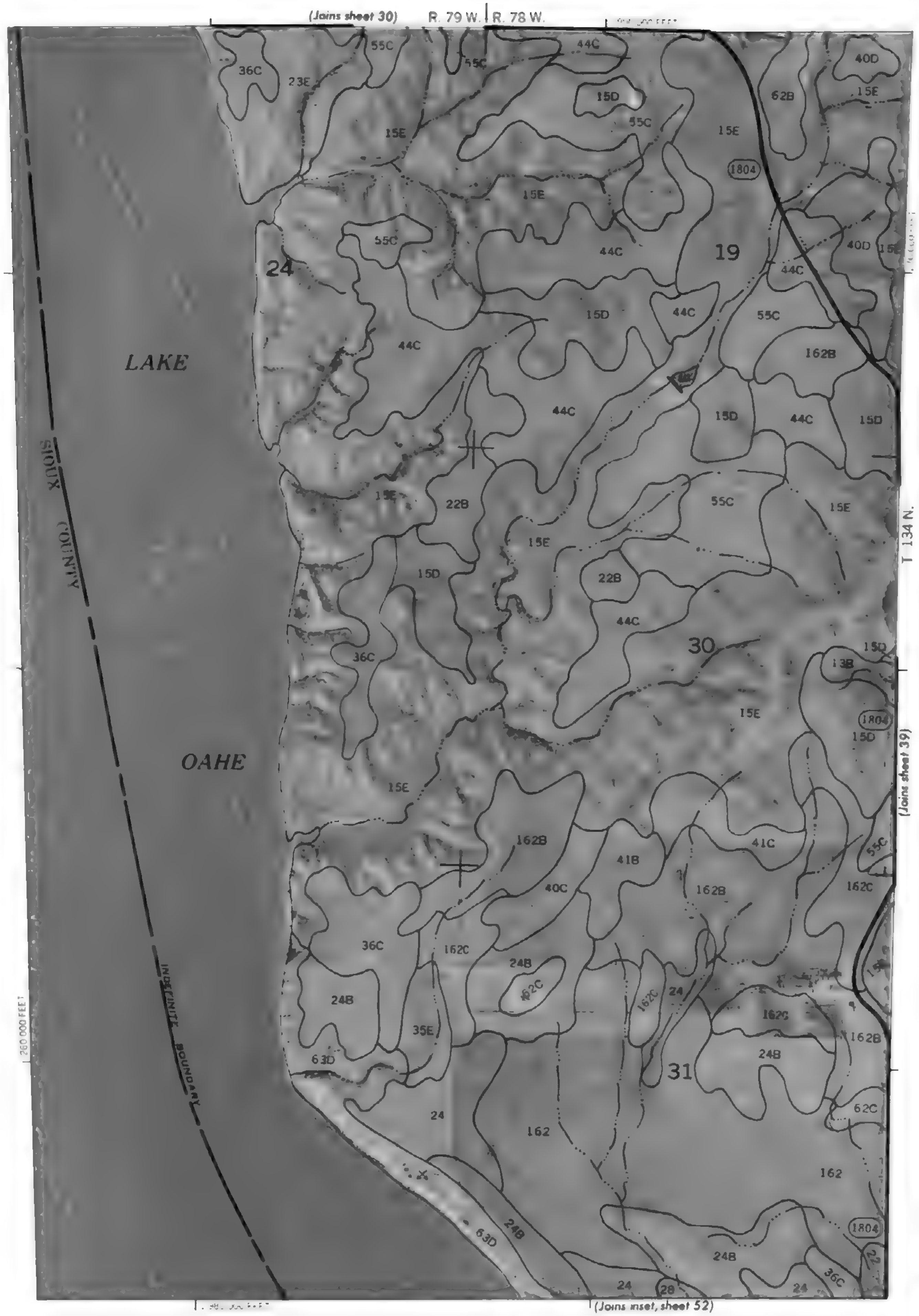

R 74 W
(Joins inset, sheet 22)
2 140 000 FEET
T 134 N.
2 285 000 FEET
(Joins sheet 36)
Long
Lake
Creek
LOGAN COUNTY
(Joins upper right)
2 145 000 FEET
275 000 FEET
1
2
11
12
13
14

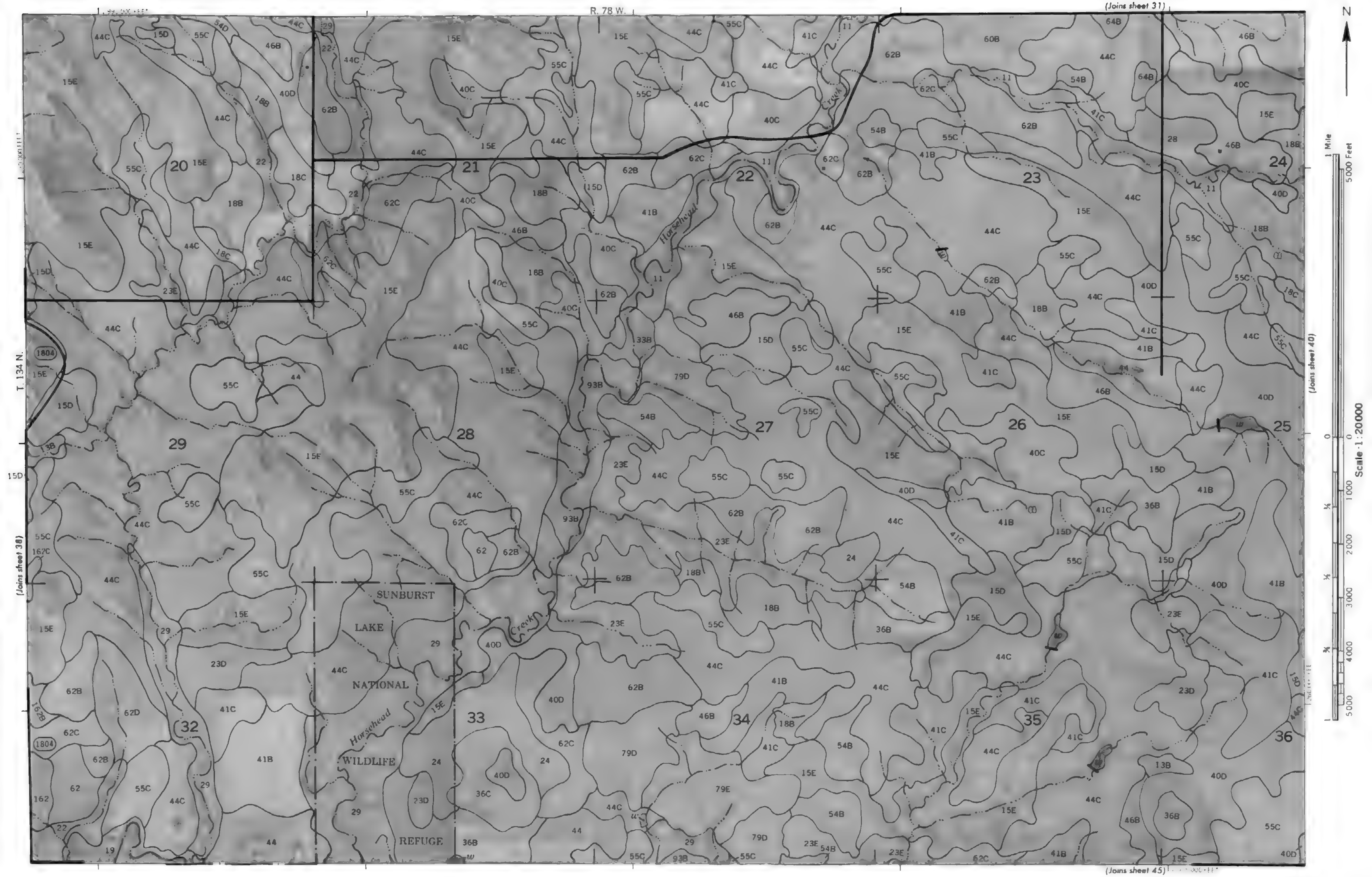

R 74 W.
(Joins lower left)
2 140 000 FEET
270 000 FEET
T 134 N
(Joins sheet 44)
LOGAN COUNTY
(Joins sheet 51)
2 145 000 FEET
265 000 FEET
23
24
25
26
35
36
N
1 Mile
5000 Feet
Scale 1:20000

38

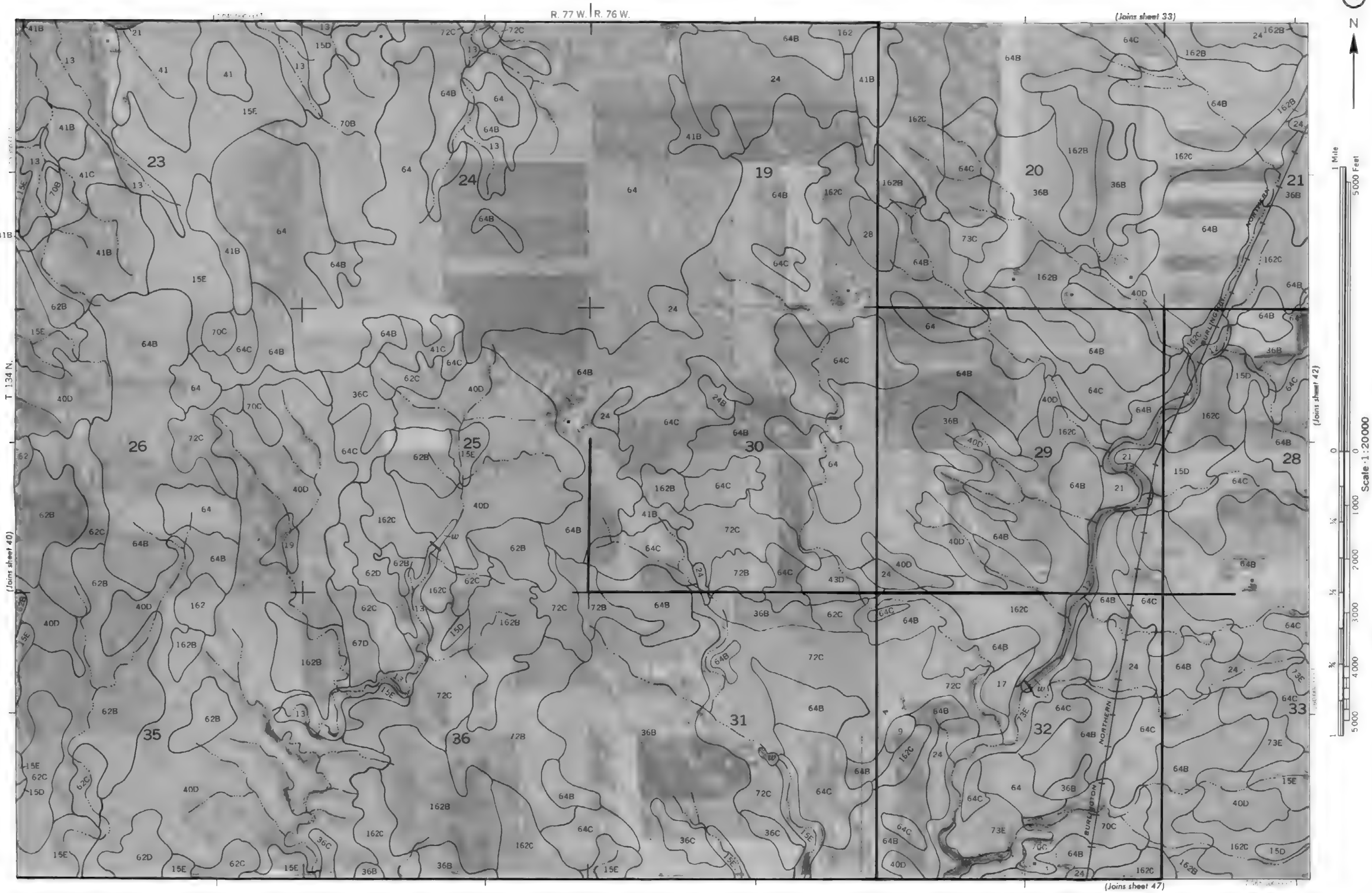

N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5 000

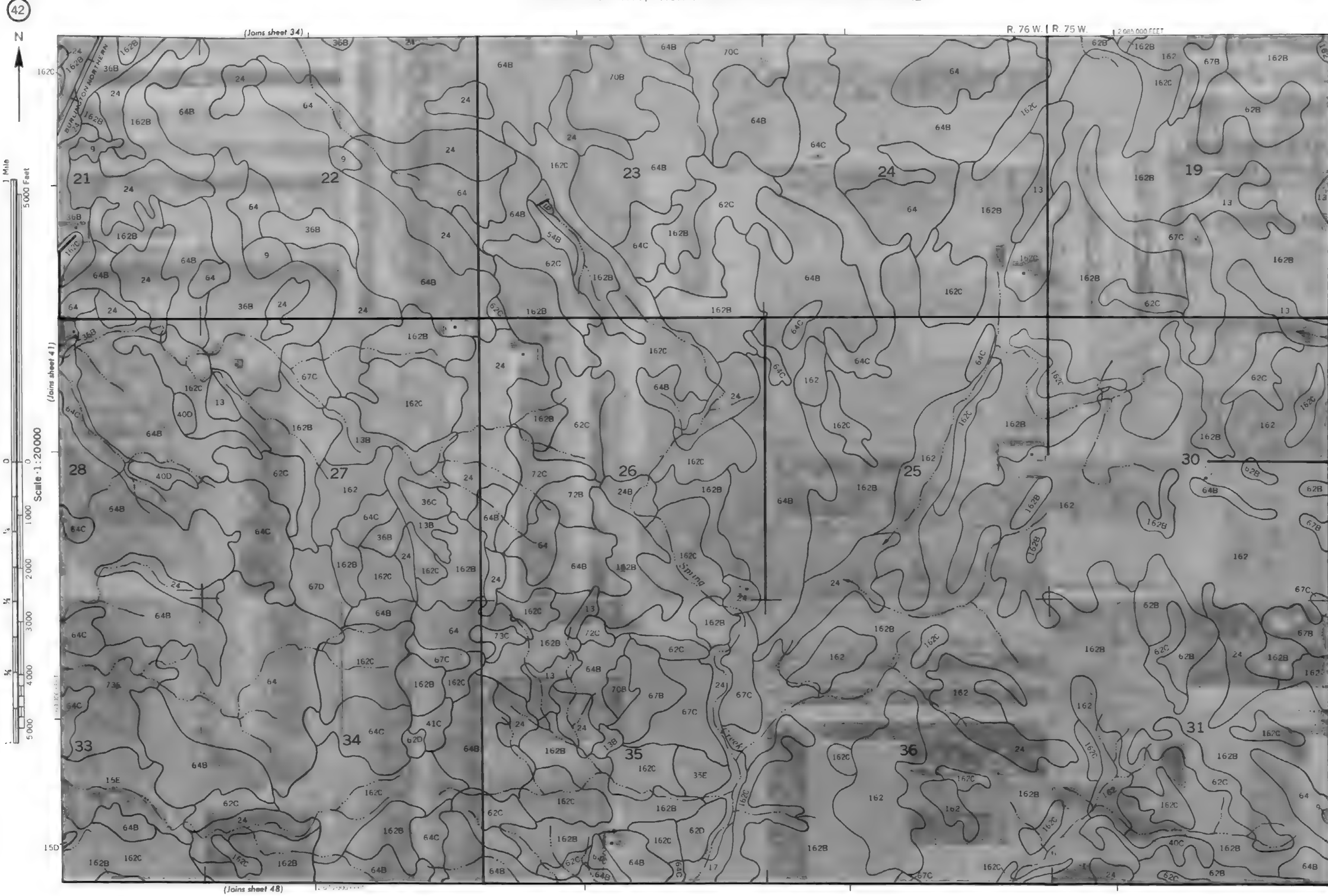

BURLEIGH COUNTY
R. 78 W.
1 970 000 FEET
LAKE
OAHE
MORTON COUNTY
INDEFINITE BOUNDARY
T. 137 N.
(Joins sheet 1)
5
4
9
84
88
98


(Joins sheet 30)
R. 79 W. R. 78 W.
LAKE
OAHE
SIOUX COUNTY
INDEFINITE BOUNDARY
T. 134 N.
(Joins sheet 39)
(Joins inset, sheet 52)
24
19
30
31
1804
36C
23E
55C
44C
15D
15E
62B
40D
22B
162B
36C
41B
41C
40C
162C
24B
35E
63D
24
162
62C
28
22

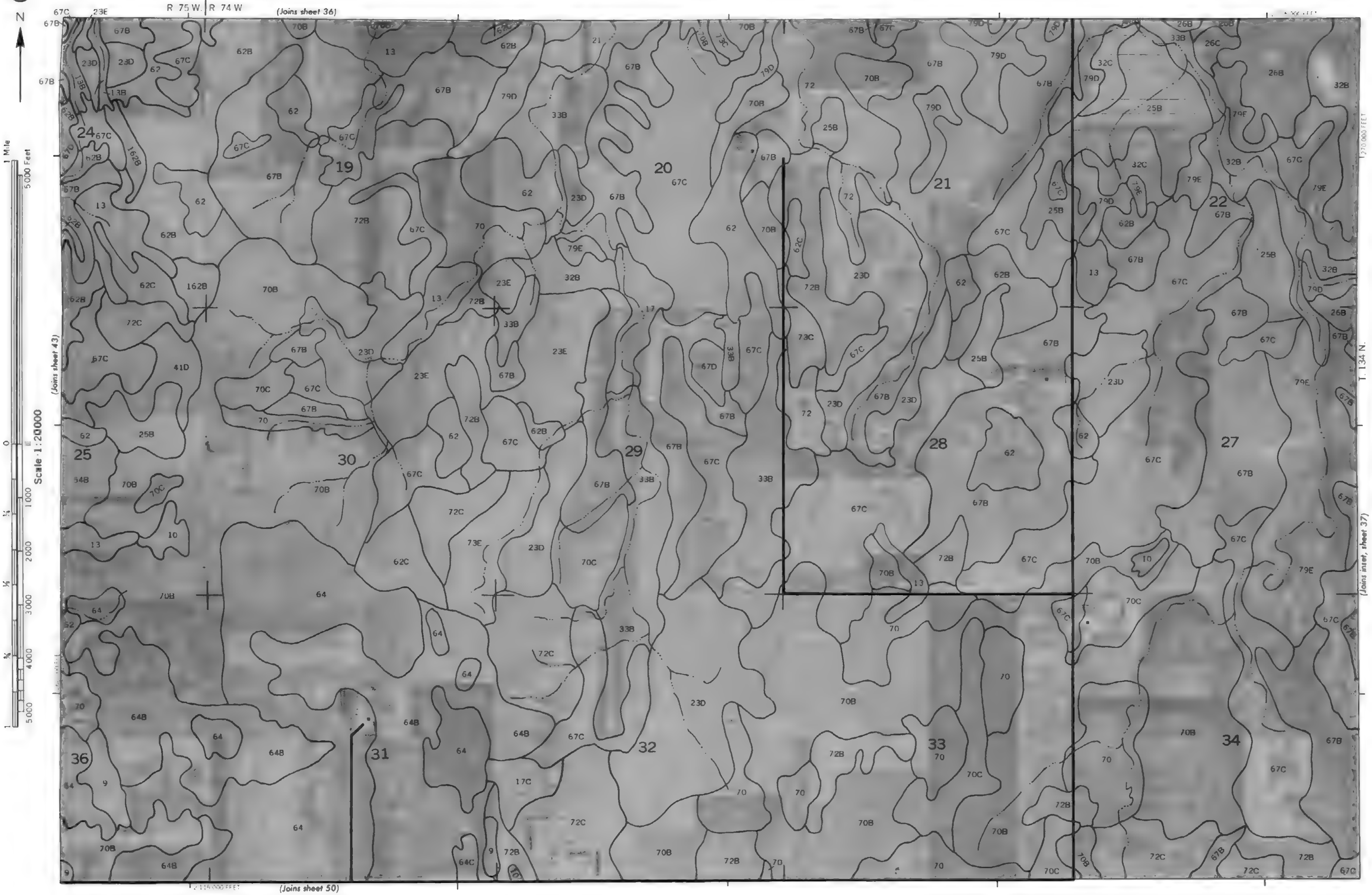

39
N
R. 78 W.
T. 134 N.
(Joins sheet 31)
(Joins sheet 40)
(Joins sheet 38)
(Joins sheet 45)
SUNBURST
LAKE
NATIONAL
WILDLIFE
REFUGE
Horsehead
Creek
1804
1 Mile
5000 Feet
Scale 1:20000

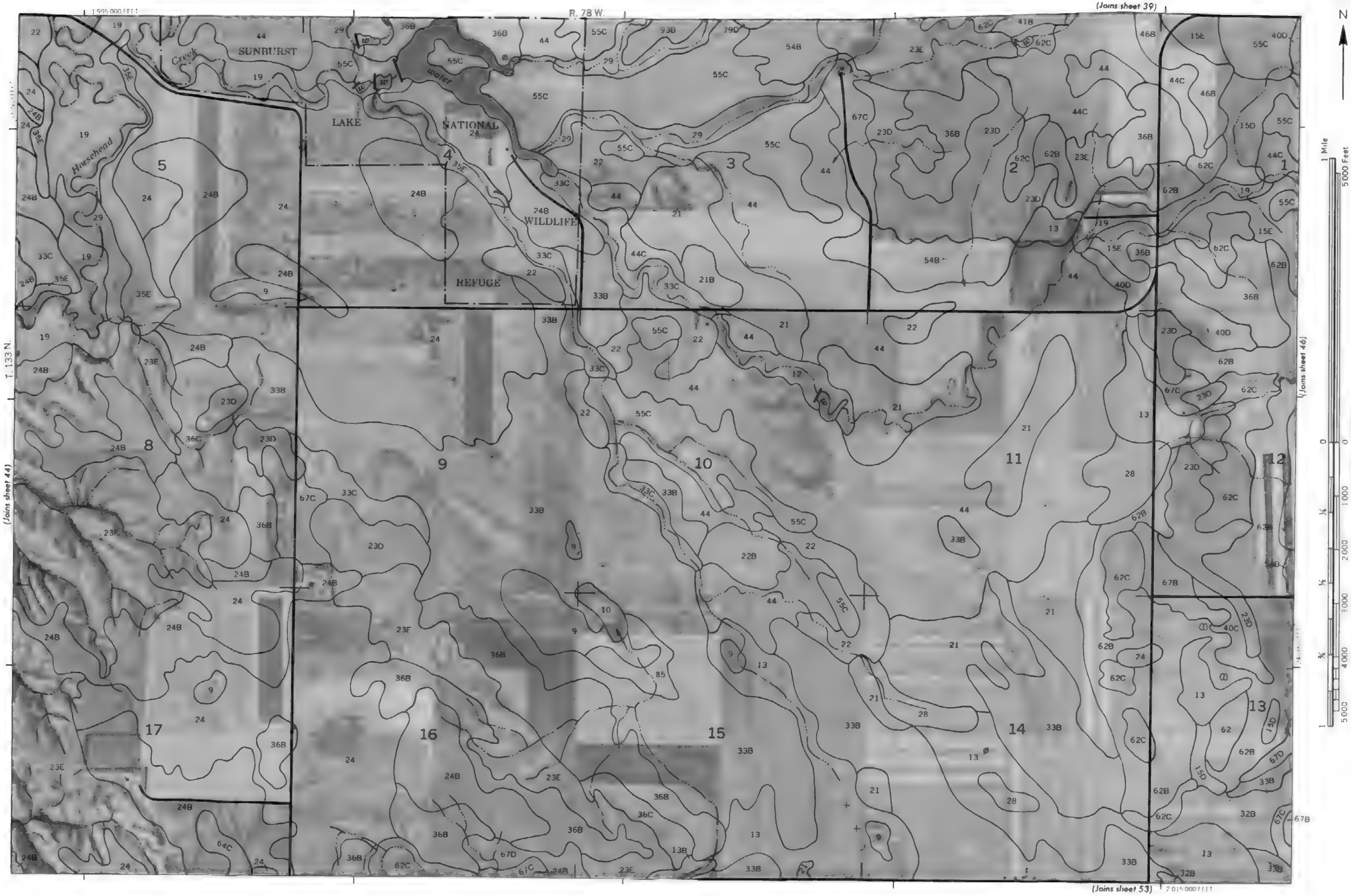
EMMONS COUNTY, NORTH DAKOTA — SHEET NUMBER 40

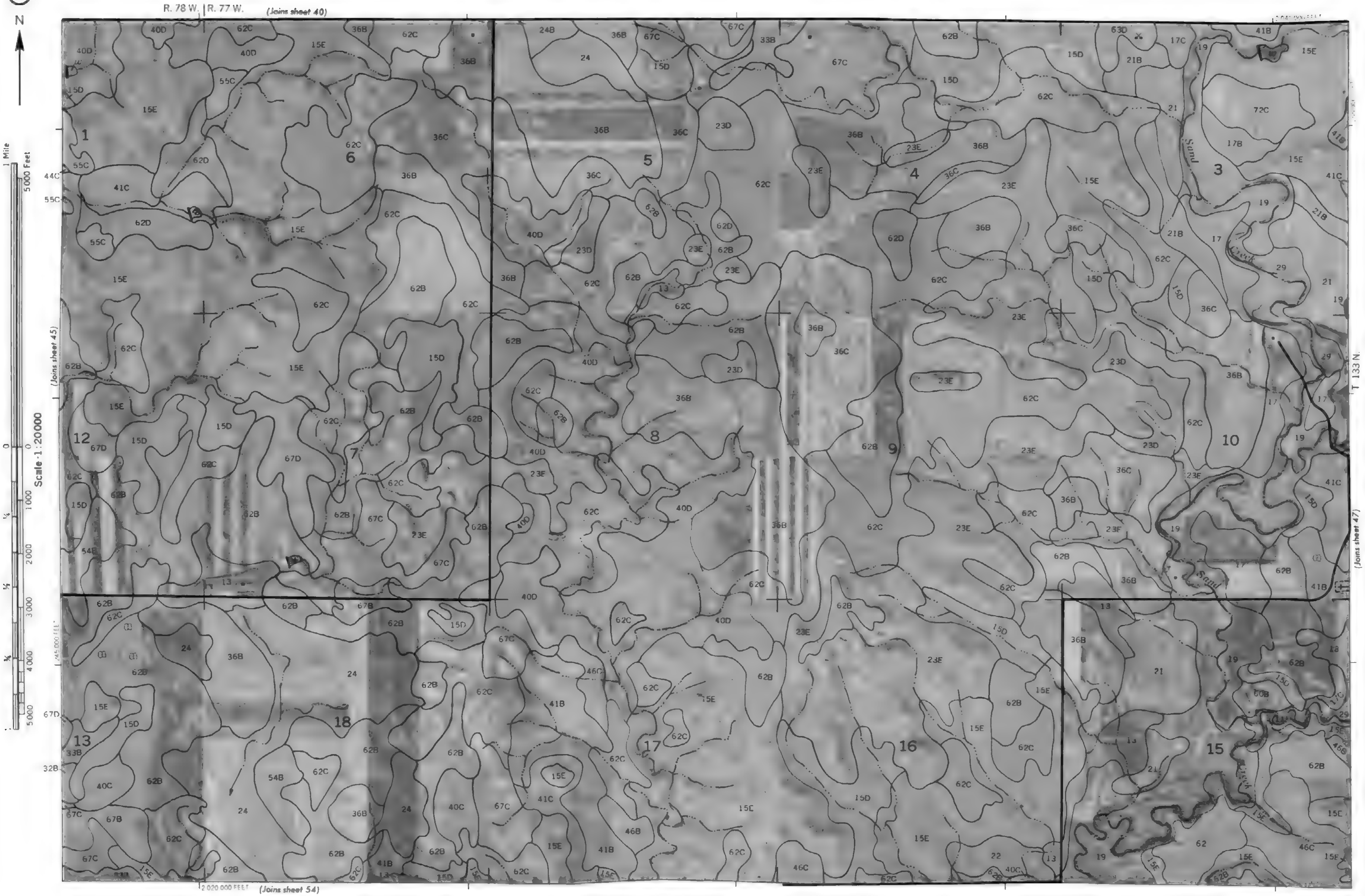

R. 77 W.
R. 76 W.
(Joins sheet 33)
(Joins sheet 42)
(Joins sheet 47)
(Joins sheet 40)
T 134 N.
N
1 Mile
5000 Feet
Scale 1:20000
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
NORTHERN
BURLINGTON


42
N
(Joins sheet 34)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 48)
R. 76 W. | R. 75 W.
T. 134 N.
BURLINGTON NORTHERN
Spring
Creek
Scale 1:20000
1 Mile
5000 Feet
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31

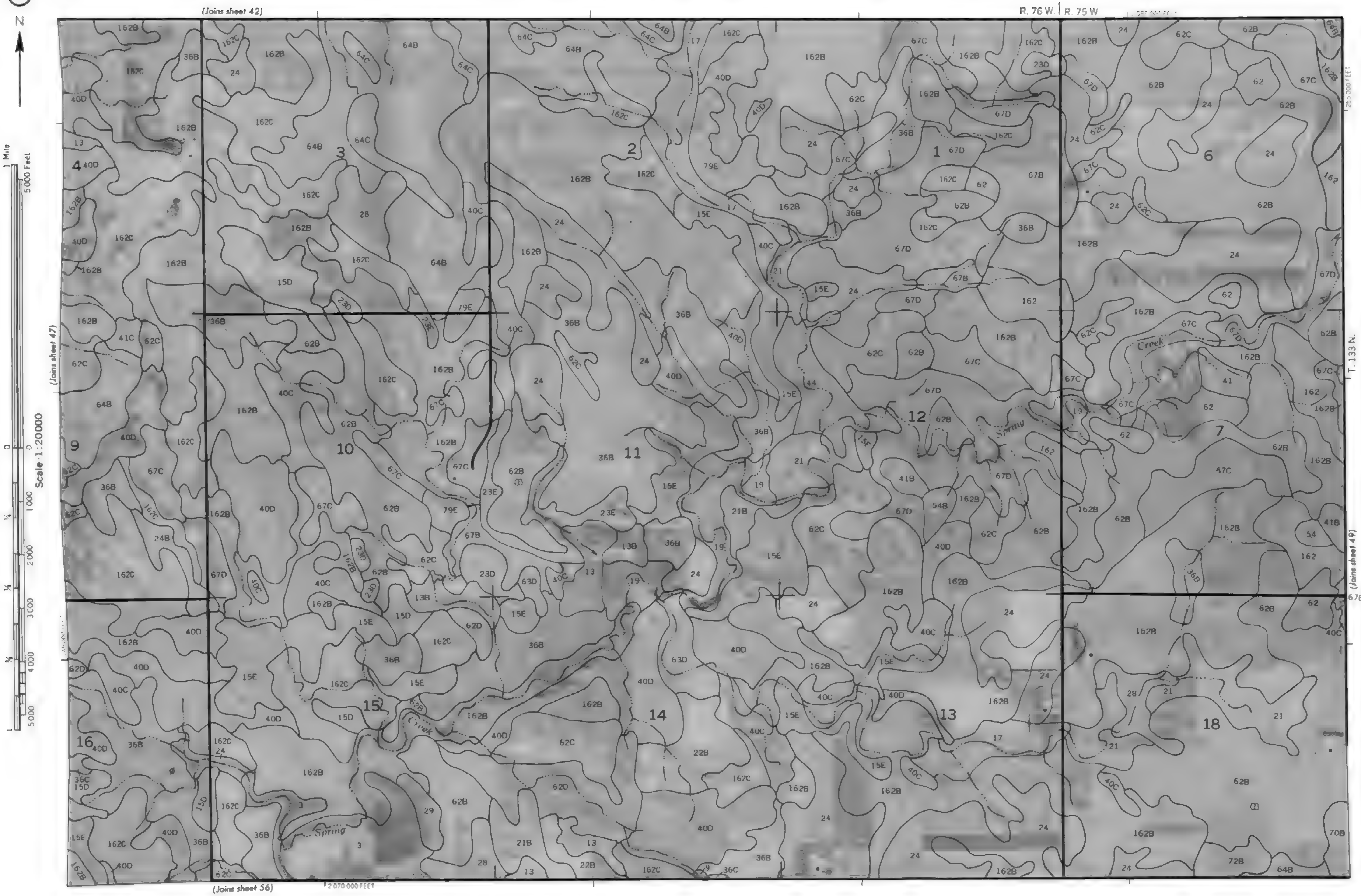

R. 75 W.
(Joins sheet 35)
(Joins sheet 44)
(Joins sheet 42)
(Joins sheet 49)
T. 134 N.
N
1 Mile
5000 Feet
Scale 1:20000
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

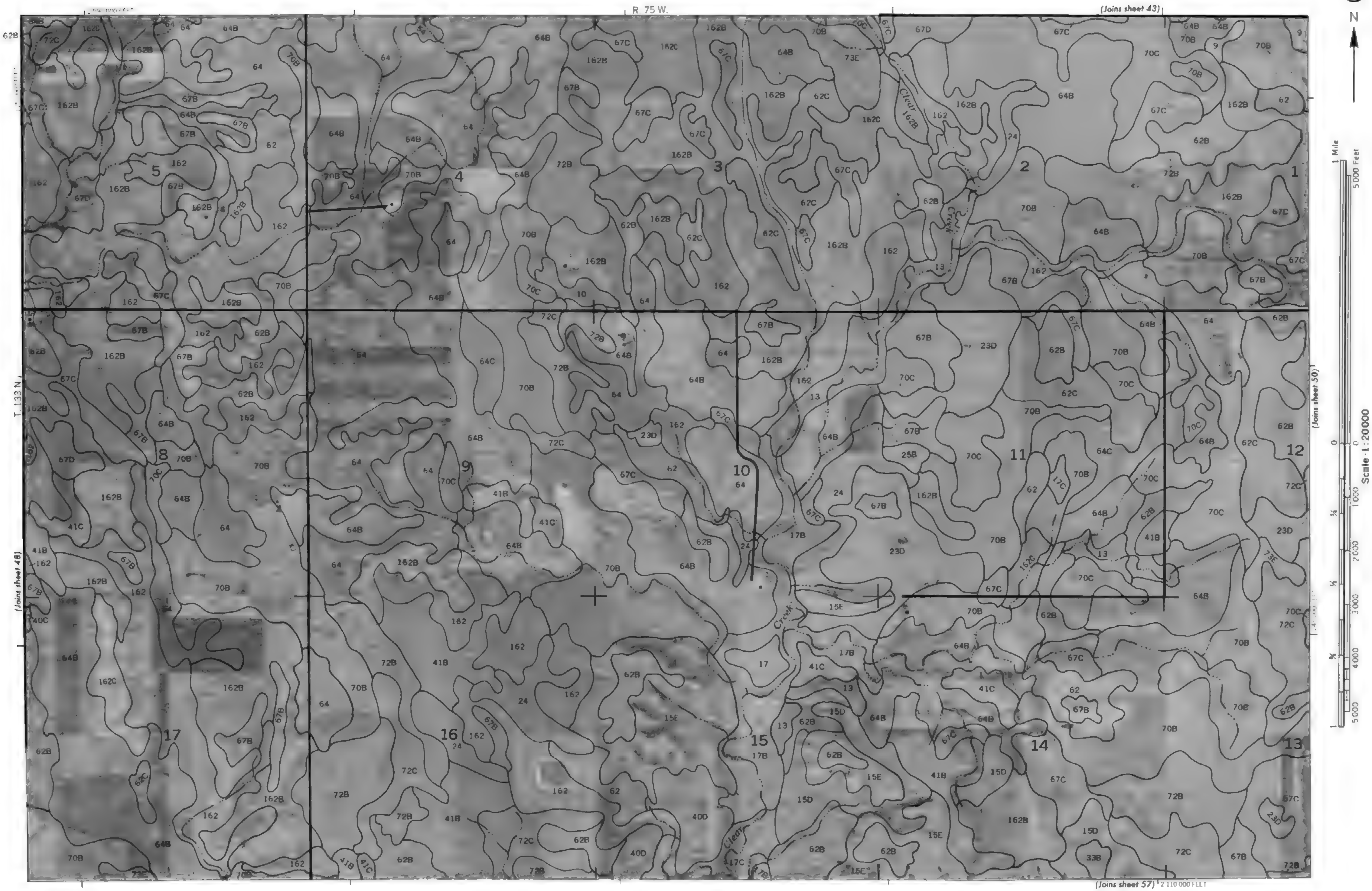

N
R 75 W.
R 74 W
(Joins sheet 36)
(Joins sheet 43)
(Joins inset, sheet 37)
(Joins sheet 50)
T. 134 N.
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36


45
N
R. 78 W.
1 995 000 FEET
(Joins sheet 39)
(Joins sheet 46)
(Joins sheet 53)
(Joins sheet 44)
2 015 000 FEET
T. 133 N.
SUNBURST
Creek
Horsehead
LAKE
NATIONAL
WILDLIFE
REFUGE
water
5
4
3
2
1
8
9
10
11
12
13
14
15
16
17
1 Mile
5000 Feet
Scale 1:20000

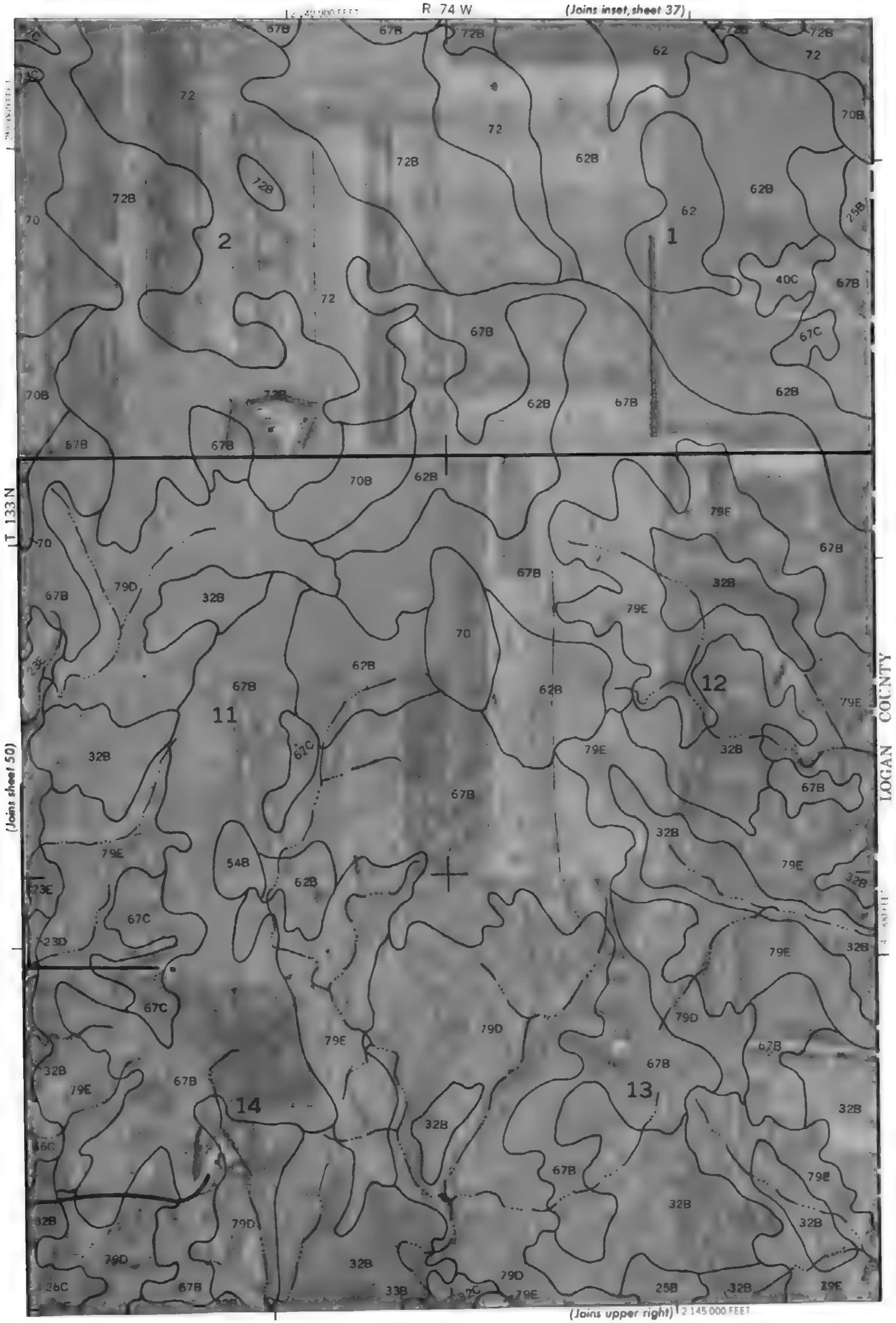

N
R. 78 W.
R. 77 W.
(Joins sheet 40)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 54)
T. 133 N.
Scale 1:20000
1 Mile
5000 Feet
2 020 000 FEET
Sand Creek

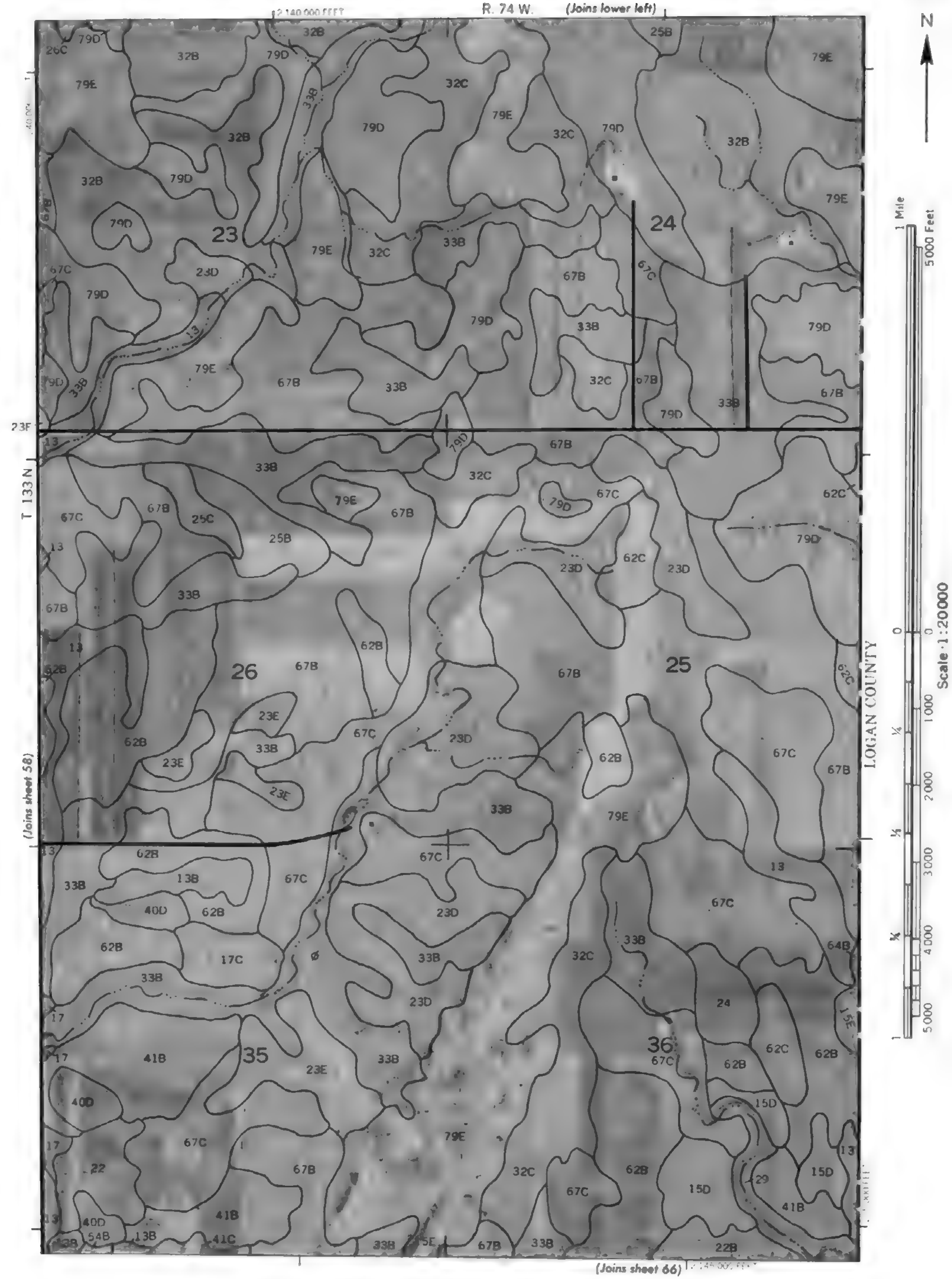
2 045 000 FEET
R. 77 W.
R. 76 W.
(Joins sheet 41)
(Joins sheet 48)
(Joins sheet 46)
(Joins sheet 55)
2 065 000 FEET
T. 133 N.
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
Water
NORTHERN
BURLINGTON
83

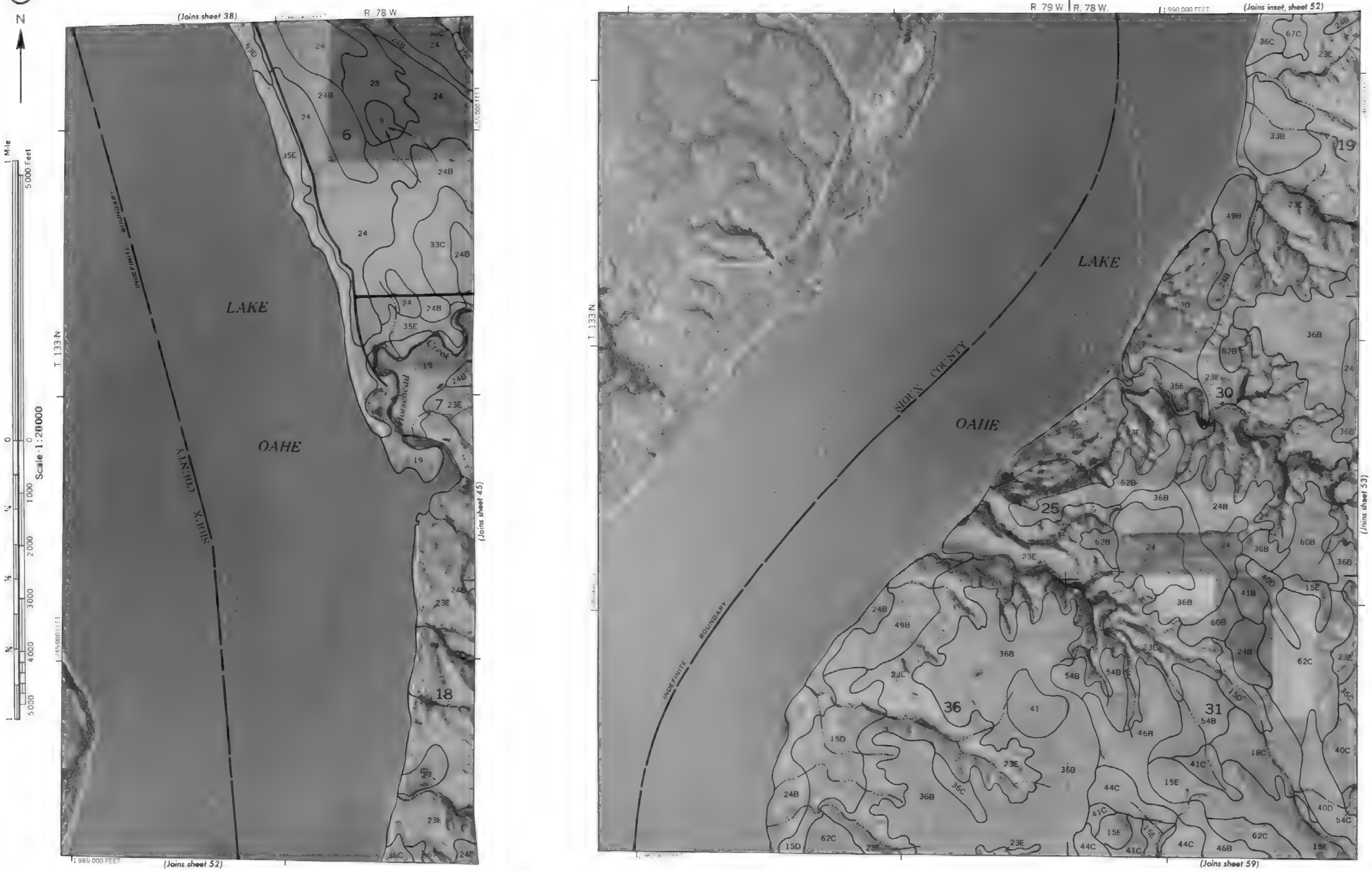

N
(Joins sheet 42)
R. 76 W.
R. 75 W
(Joins sheet 47)
(Joins sheet 49)
T. 133 N.
(Joins sheet 56)
2 070 000 FEET
Scale 1:20000
1 Mile
5000 Feet
Spring
Creek

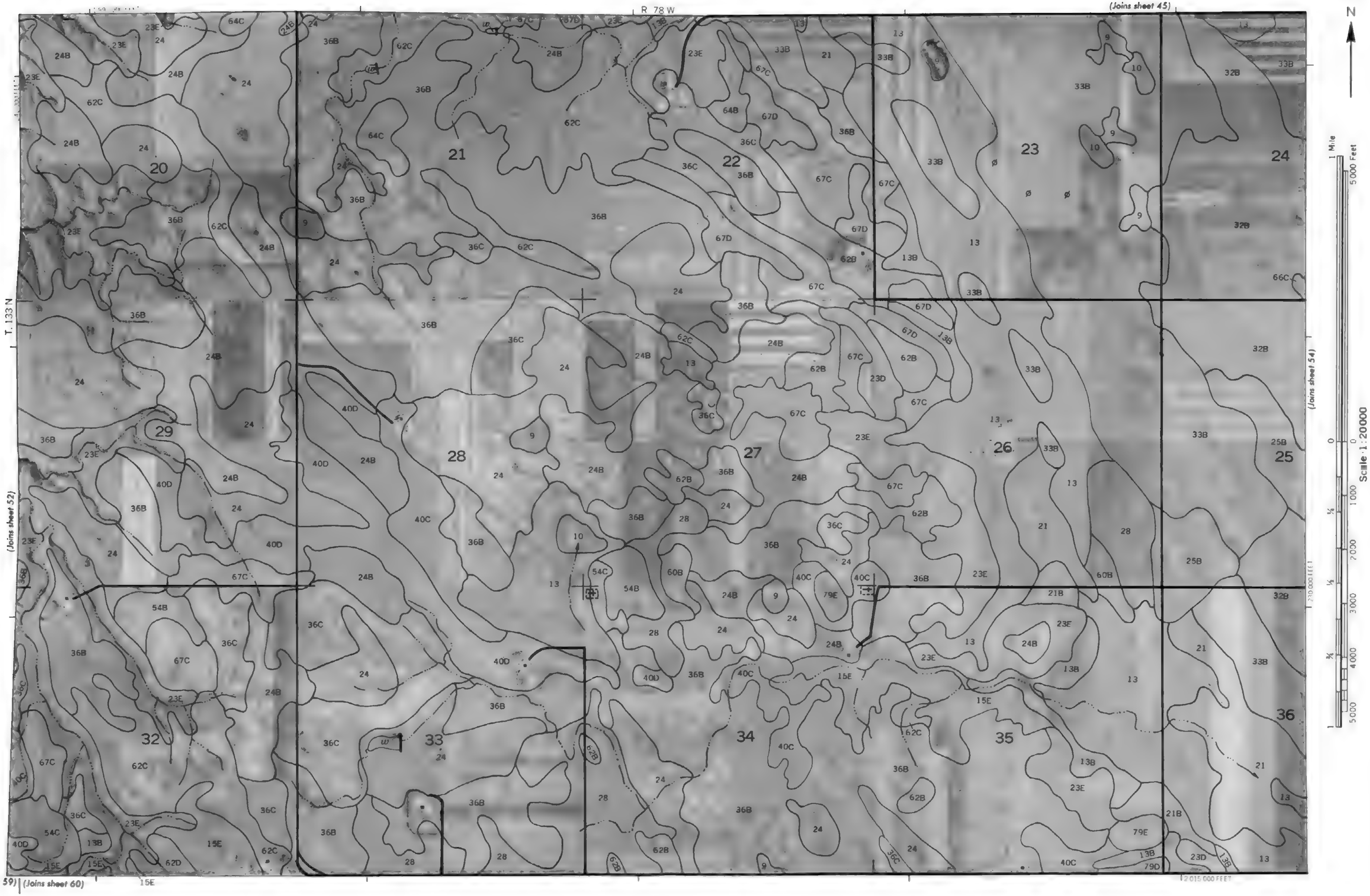

R. 75 W.
(Joins sheet 43)
(Joins sheet 50)
(Joins sheet 57)
(Joins sheet 48)
T. 133 N.
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
Clear Creek
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17


50
N
R. 75 W.
R. 74 W.
(Joins sheet 44)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 58)
T. 133 N.
2 115 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000


R 74 W
(Joins inset, sheet 37)
T 133 N
(Joins sheet 50)
LOGAN COUNTY
(Joins upper right)
2 145 000 FEET
1
2
11
12
13
14


51
N
2 140 000 FEET
R. 74 W.
(Joins lower left)
T 133 N
(Joins sheet 58)
LOGAN COUNTY
(Joins sheet 66)
23
24
25
26
35
36
1 Mile
5000 Feet
Scale 1:20000

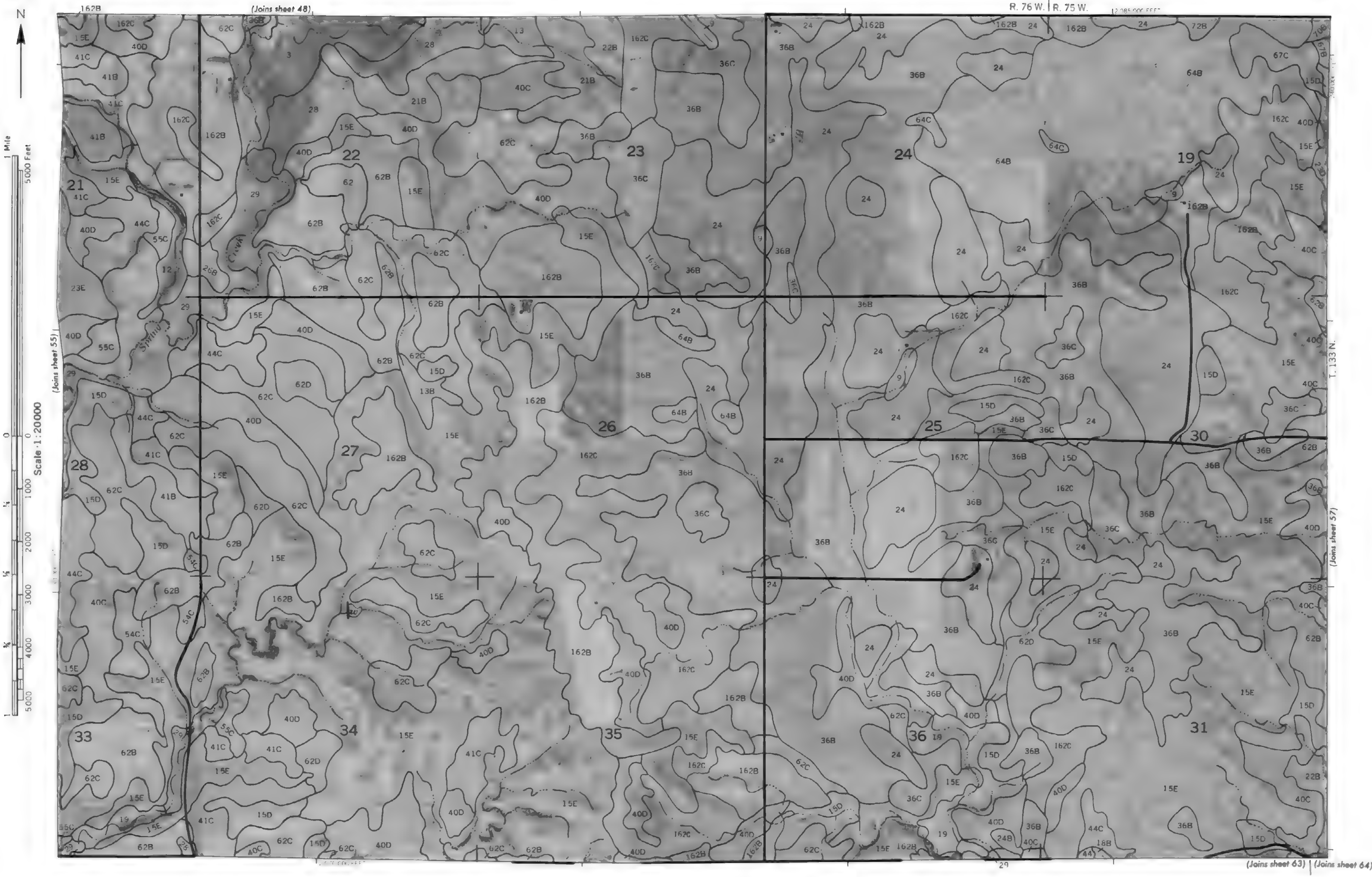

N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 38)
R. 78 W.
T. 133 N.
LAKE
OAHE
SIOUX COUNTY
INDEFINITE BOUNDARY
Horsehead Creek
(Joins sheet 45)
1 986 000 FEET
(Joins sheet 52)
R. 79 W. | R. 78 W.
1 990 000 FEET
(Joins inset, sheet 52)
(Joins sheet 53)
(Joins sheet 59)
6
7
18
19
25
30
31
36

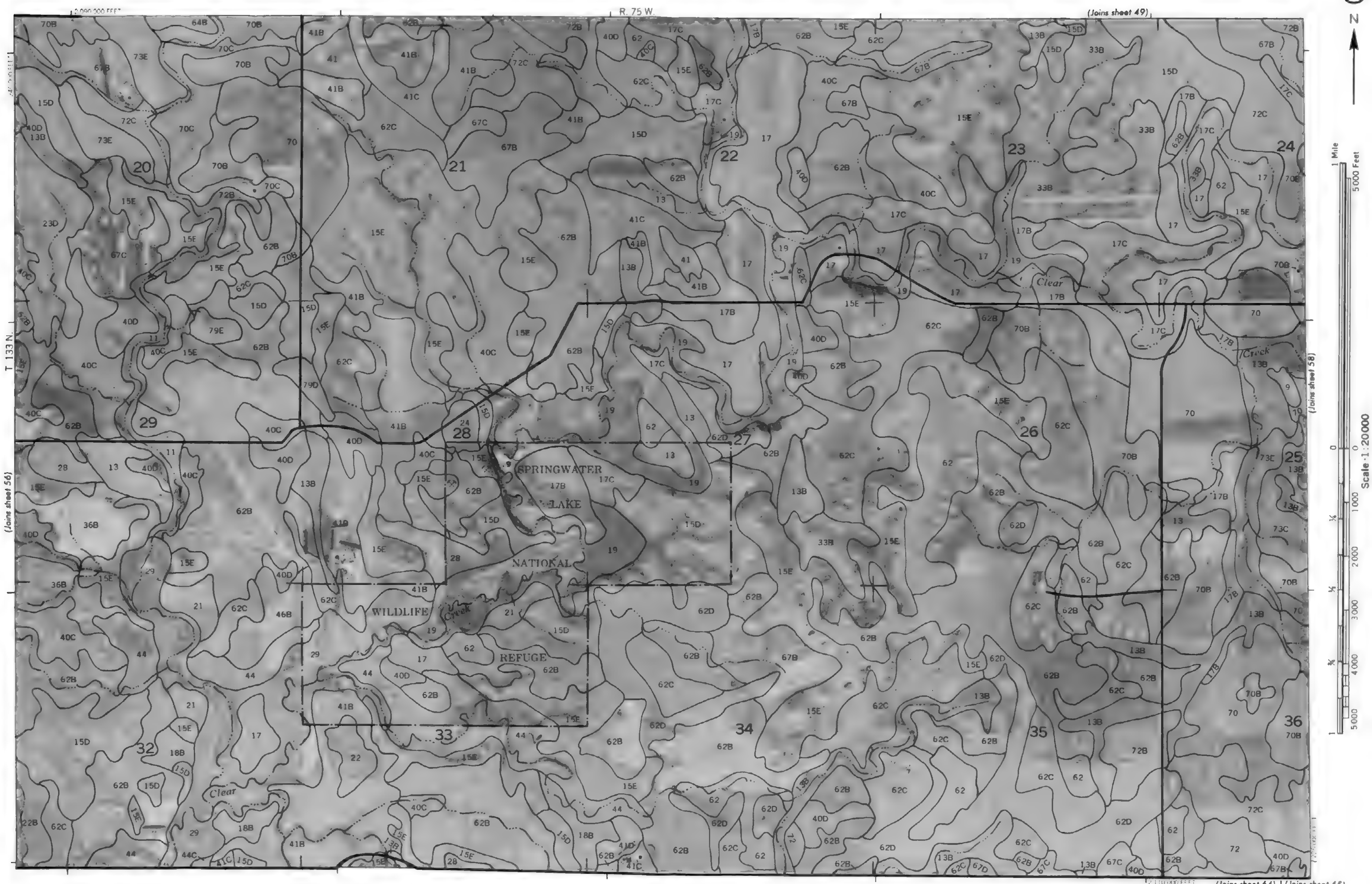

R 78 W
(Joins sheet 45)
N
T. 133 N
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 59)
(Joins sheet 60)
1 Mile
5000 Feet
Scale 1:20000
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

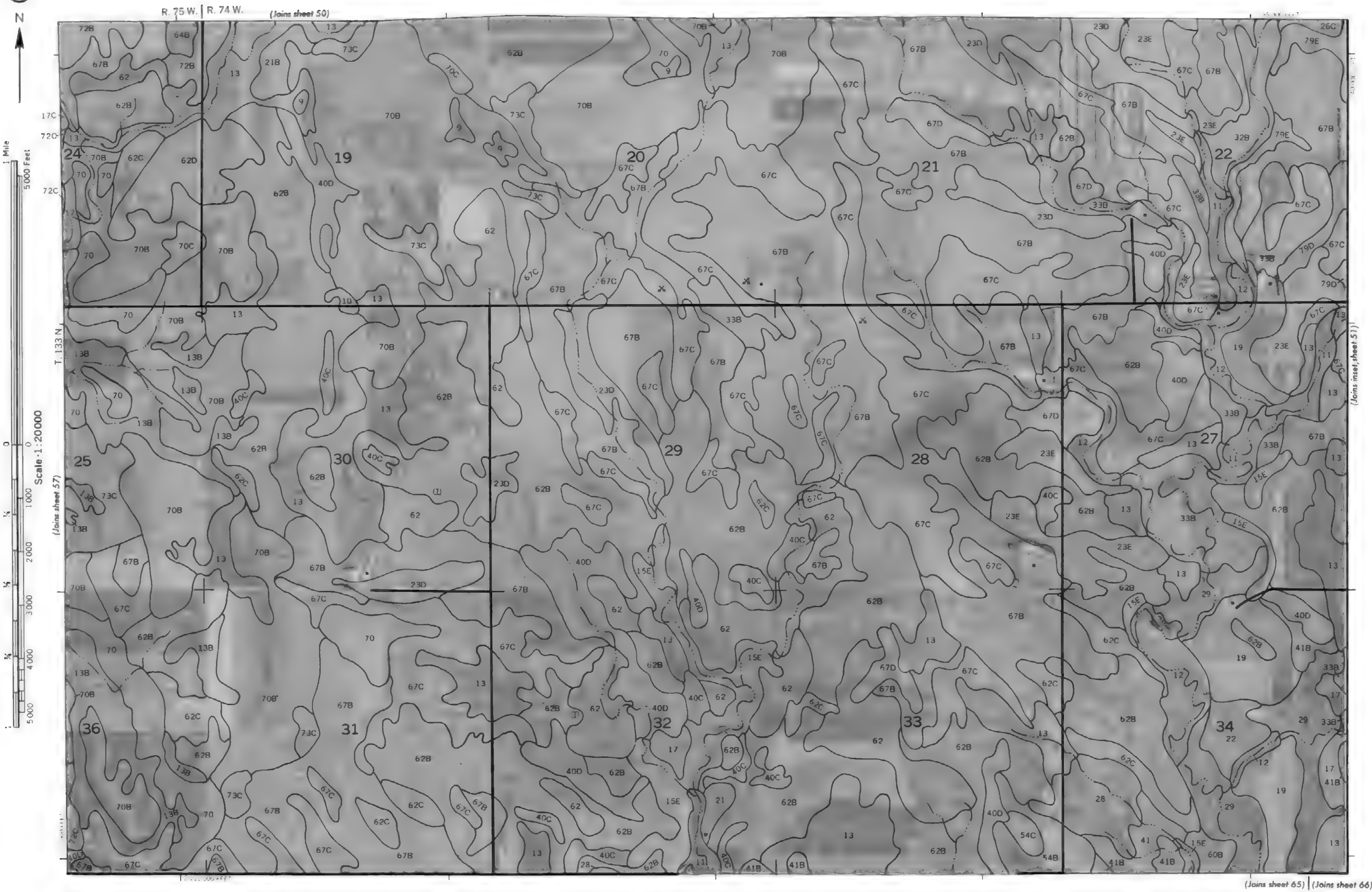
54
N
R. 78 W.
R. 77 W.
(Joins sheet 46)
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 60)
(Joins sheet 61)
T. 133 N.
Scale 1:20000
1 Mile
5000 Feet
Sand Creek
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36

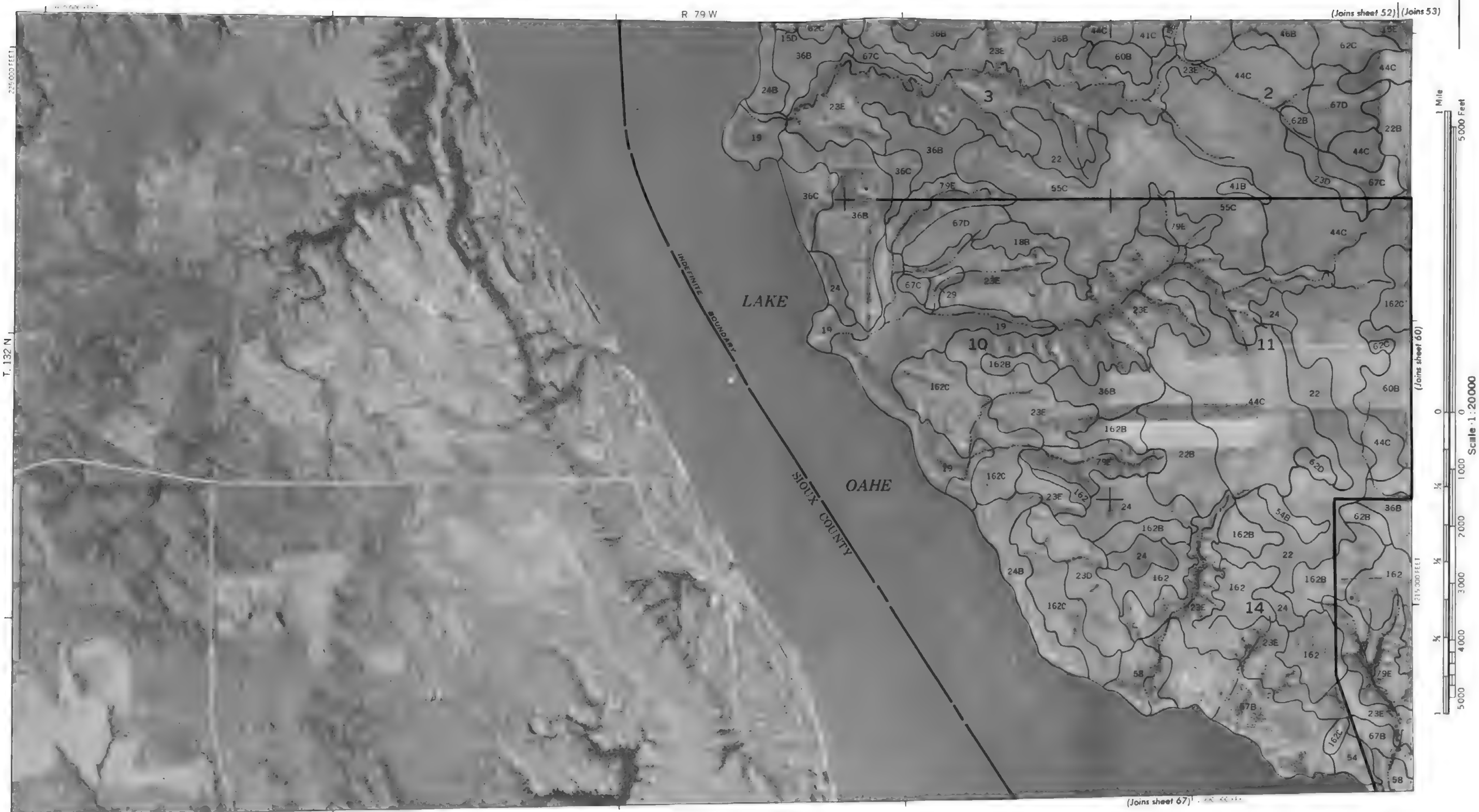

R. 77 W. | R. 76 W.
(Joins sheet 47)
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 61) | (Joins sheet 62)
T. 133 N.
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
BURLINGTON NORTHERN
Creek
83
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

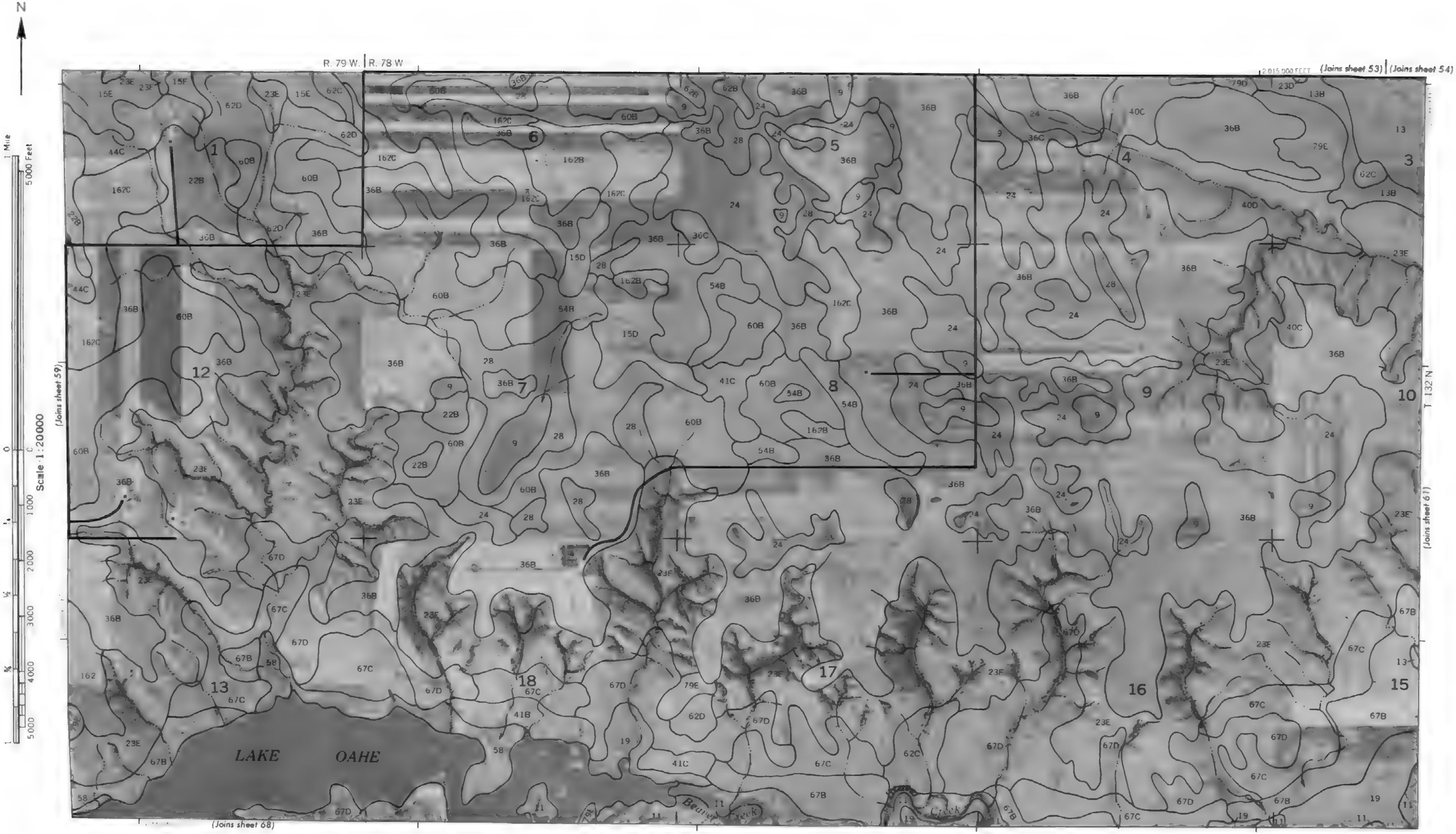
EMMONS COUNTY, NORTH DAKOTA — SHEET NUMBER 56



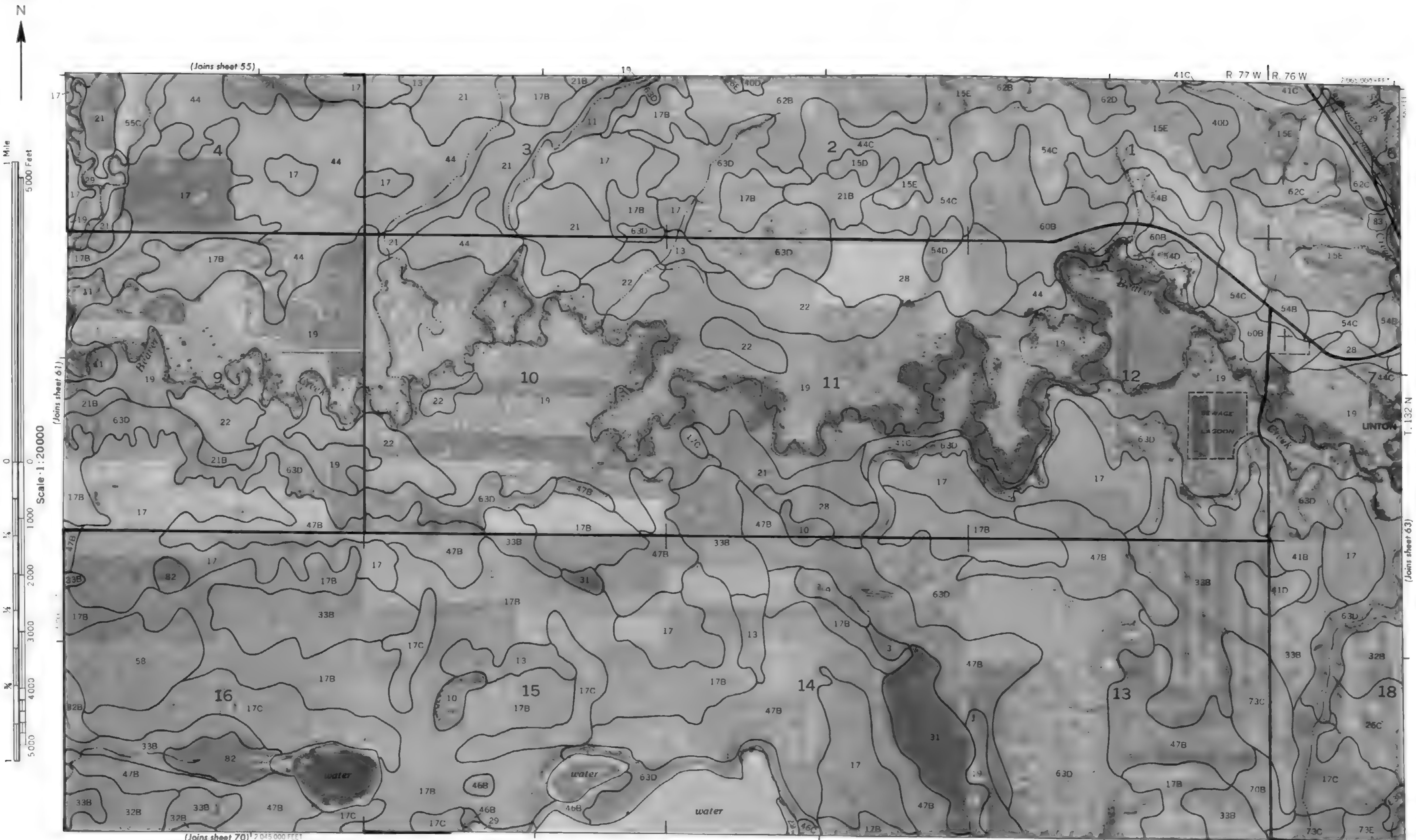

57
N
R. 75 W.
(Joins sheet 49)
(Joins sheet 56)
(Joins sheet 58)
(Joins sheet 64)
(Joins sheet 65)
T. 133 N.
2 090 000 FEET
SPRINGWATER
LAKE
NATIONAL
WILDLIFE
REFUGE
Clear
Creek
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
1 Mile
5000 Feet
Scale 1:20000

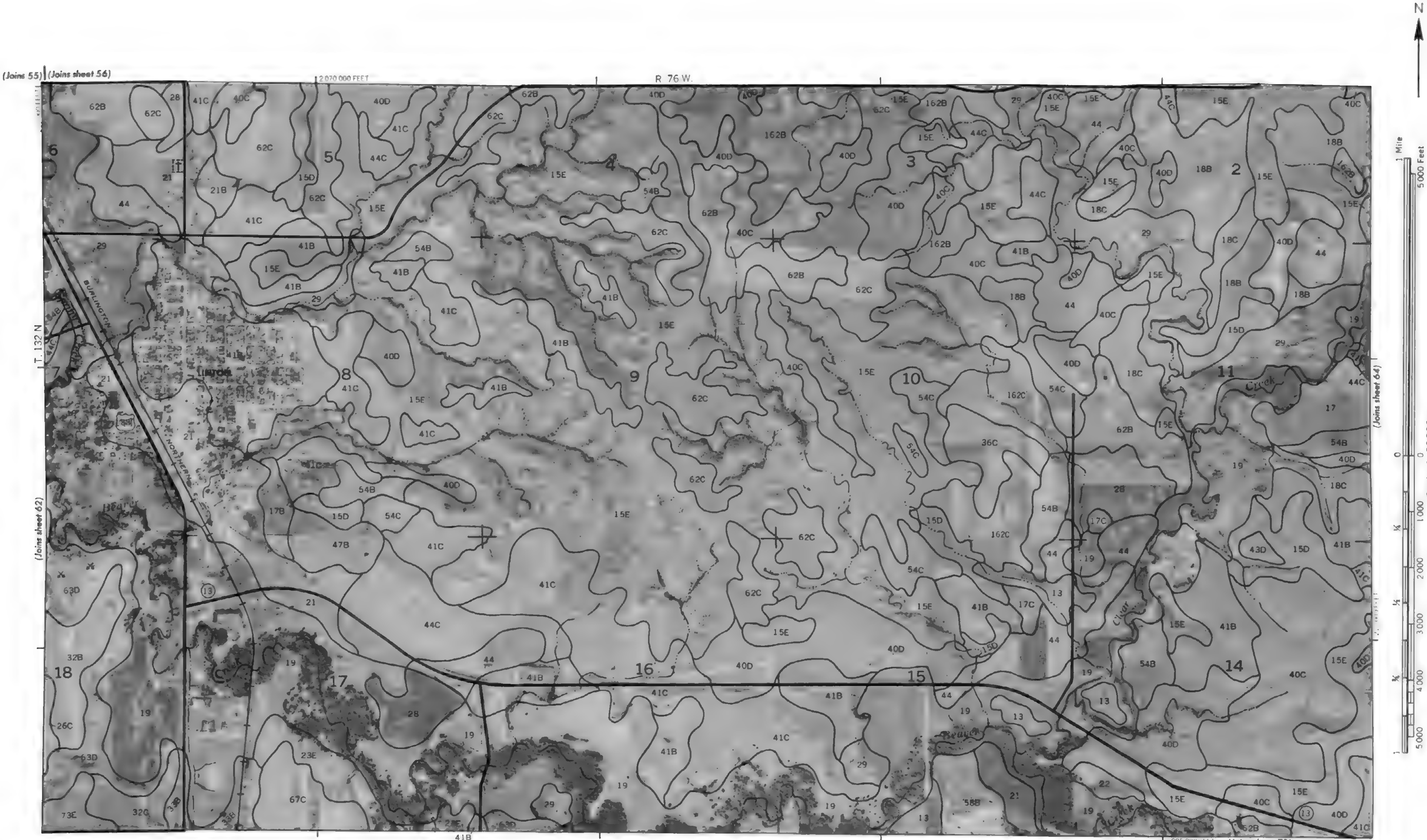

N
R. 75 W.
R. 74 W.
(Joins sheet 50)
T. 133 N.
(Joins sheet 57)
(Joins inset, sheet 51)
(Joins sheet 65)
(Joins sheet 66)
1 Mile
5000 Feet
Scale 1:20000
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36


N
R. 79 W.
(Joins sheet 52)
(Joins 53)
T. 132 N.
LAKE
OAHE
INDEFINITE BOUNDARY
SIOUX COUNTY
(Joins sheet 60)
(Joins sheet 67)
3
2
10
11
14
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000

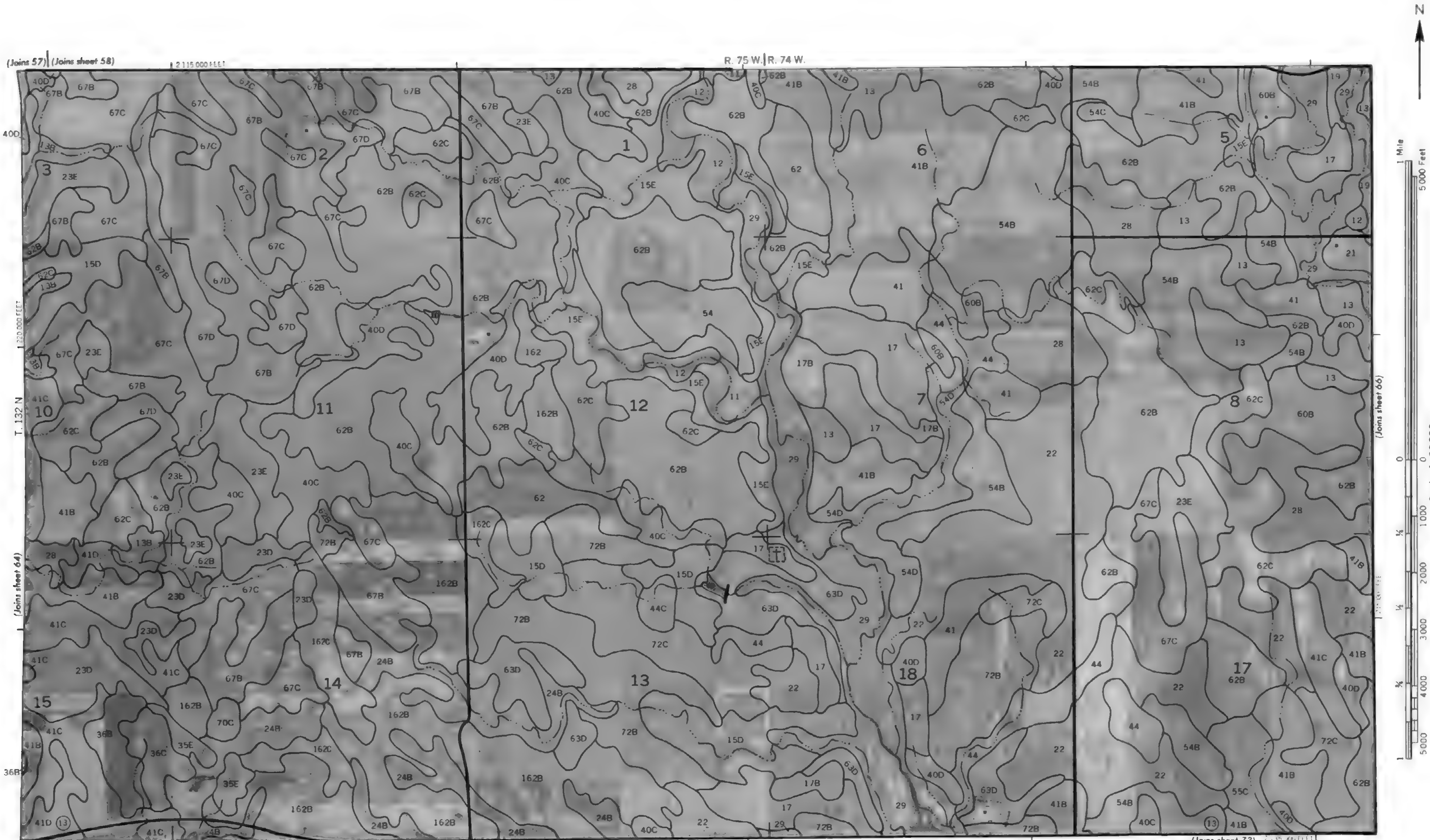

N
R. 79 W.
R. 78 W.
(Joins sheet 53)
(Joins sheet 54)
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 68)
T. 132 N.
Scale 1:20000
1 Mile
5000 Feet
LAKE OAHE
Beaver Creek


61
N
R. 78 W. | R. 77 W.
(Joins sheet 54) | (Joins 55)
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 69)
T. 132 N.
2 040 000 FEET
1 Mile
5 000 Feet
Scale 1:20000
Sand Creek
Beaver Creek
Spring Creek


N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 55)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 70)
R. 77 W
R. 76 W
T. 132 N
LINTON
SEWAGE LAGOON
Beaver Creek
water
water
water

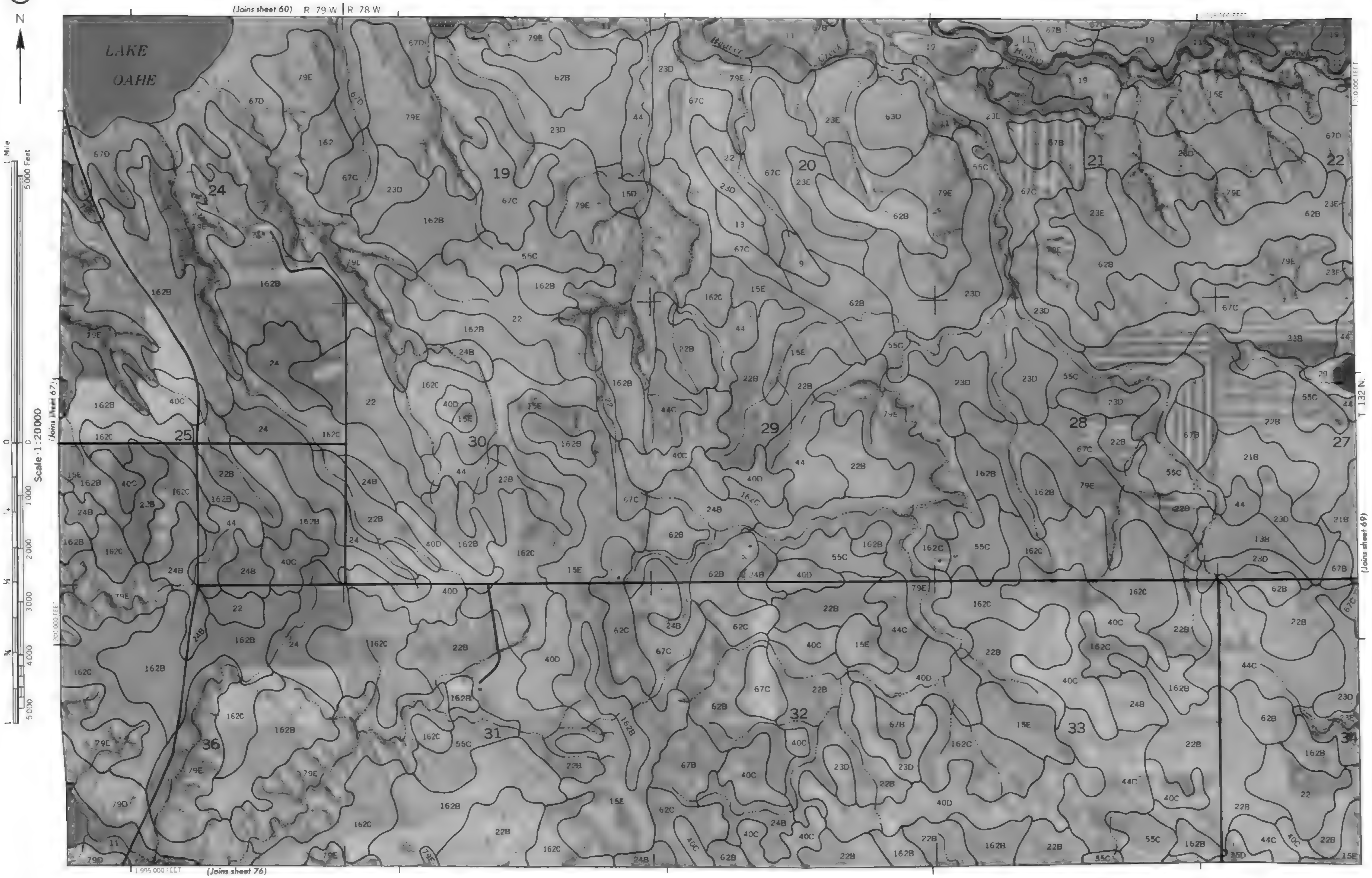

N
(Joins 55)
(Joins sheet 56)
2 070 000 FEET
R. 76 W.
T. 132 N.
(Joins sheet 62)
(Joins sheet 64)
(Joins sheet 71)
2 085 000 FEET
Linton
BURLINGTON
NORTHERN
Beaver
Creek
Clear
1 Mile
5000 Feet
Scale 1:20000

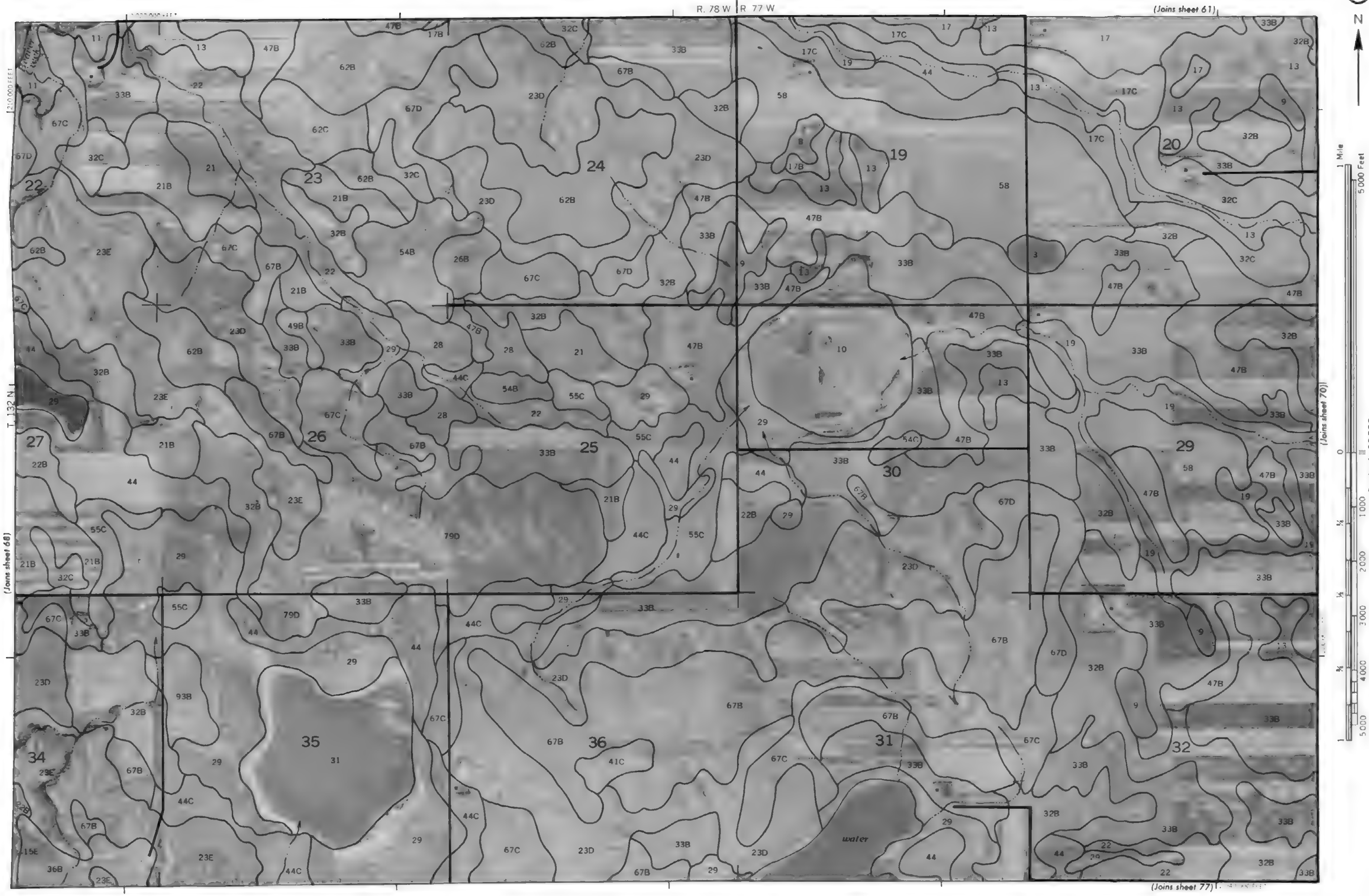

N
1 Mile
5000 Feet
Scale 1:20000
(Joins 56)
(Joins sheet 57)
R 76 W
R 75 W
(Joins sheet 63)
(Joins sheet 65)
(Joins sheet 72)
T 132 N.
Clear Creek

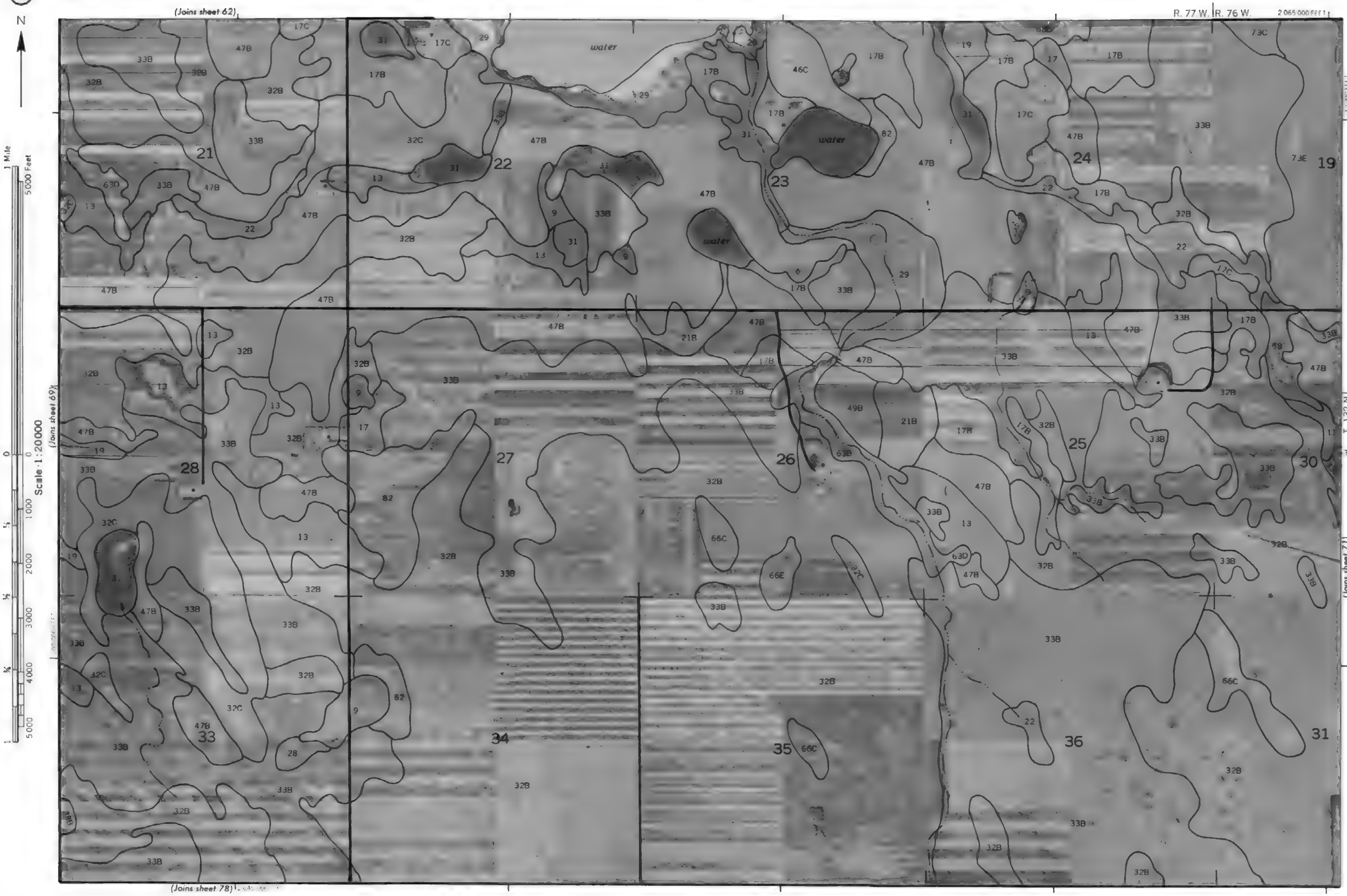

N
(Joins sheet 57)
(Joins sheet 58)
2 115 000 FEET
R. 75 W.
R. 74 W.
T. 132 N.
(Joins sheet 64)
(Joins sheet 66)
(Joins sheet 73)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000

EMMONS COUNTY, NORTH DAKOTA — SHEET NUMBER 66

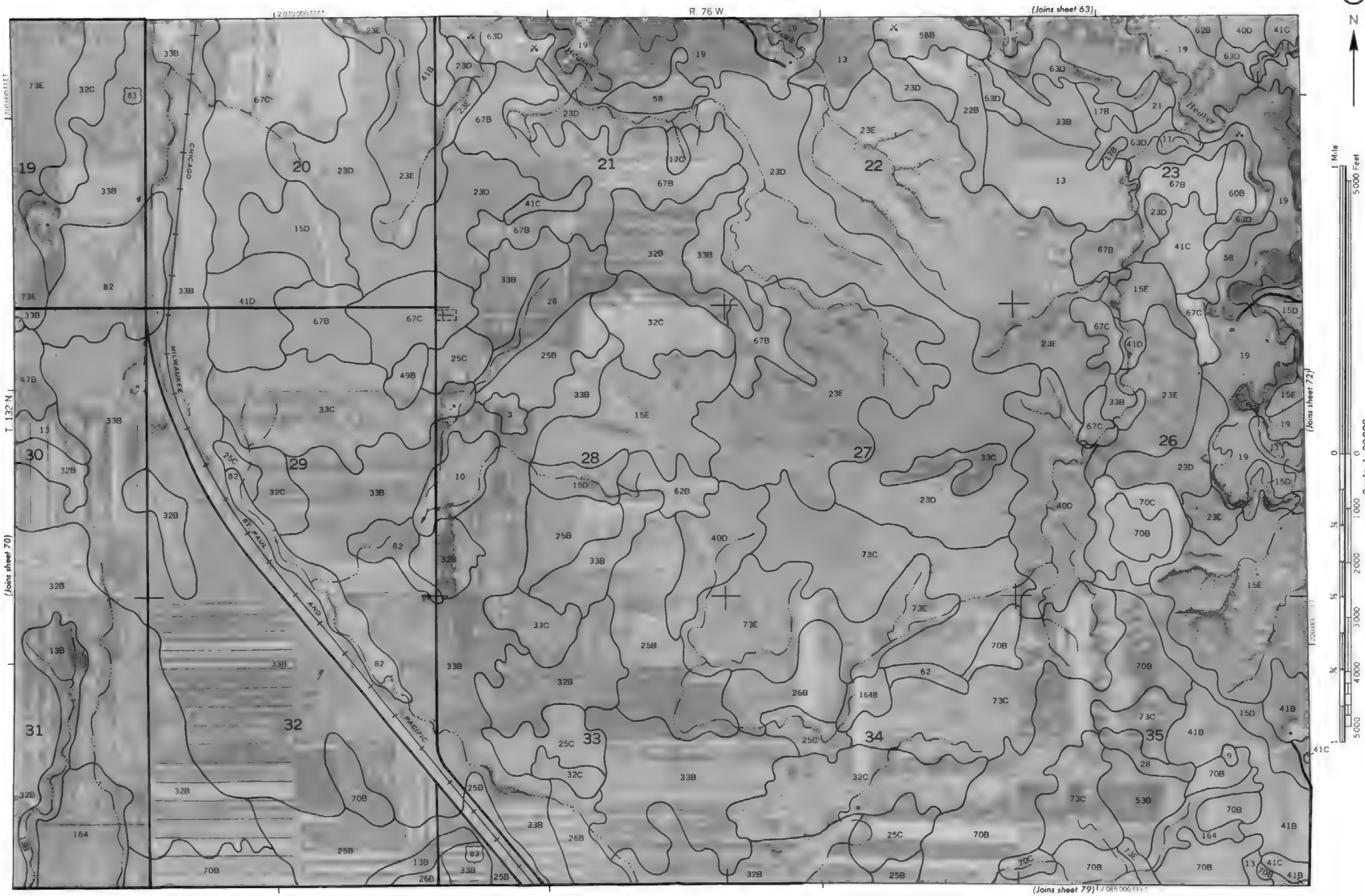

67
N
R. 79 W.
(Joins sheet 59)
T 132 N
SIOUX COUNTY
INDEFINITE BOUNDARY
LAKE
OAHE
(Joins sheet 68)
(Joins sheet 75)
1 Mile
5000 Feet
Scale 1:20000
23
26
34
35
19
162C
67D
79E
162B
162C
15D
40D
24B
36C
36B
23E
15E
79D
23D
11
62B
22B
22
36B
40D

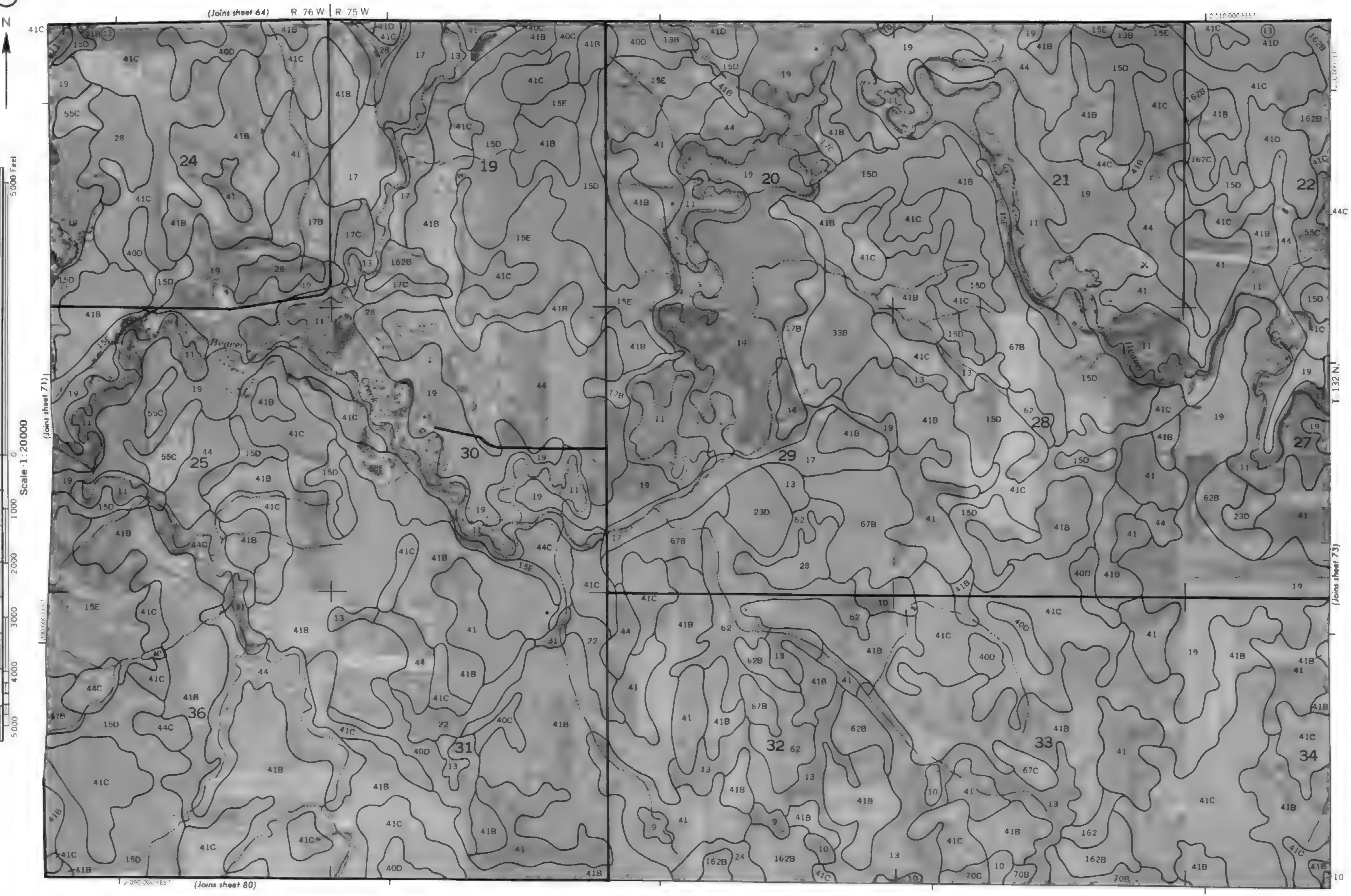

N
(Joins sheet 60)
R. 79 W.
R. 78 W.
LAKE
OAHE
Beaver Creek
(Joins sheet 67)
(Joins sheet 69)
(Joins sheet 76)
T. 132 N.
Scale 1:20000
1 Mile
5000 Feet
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36

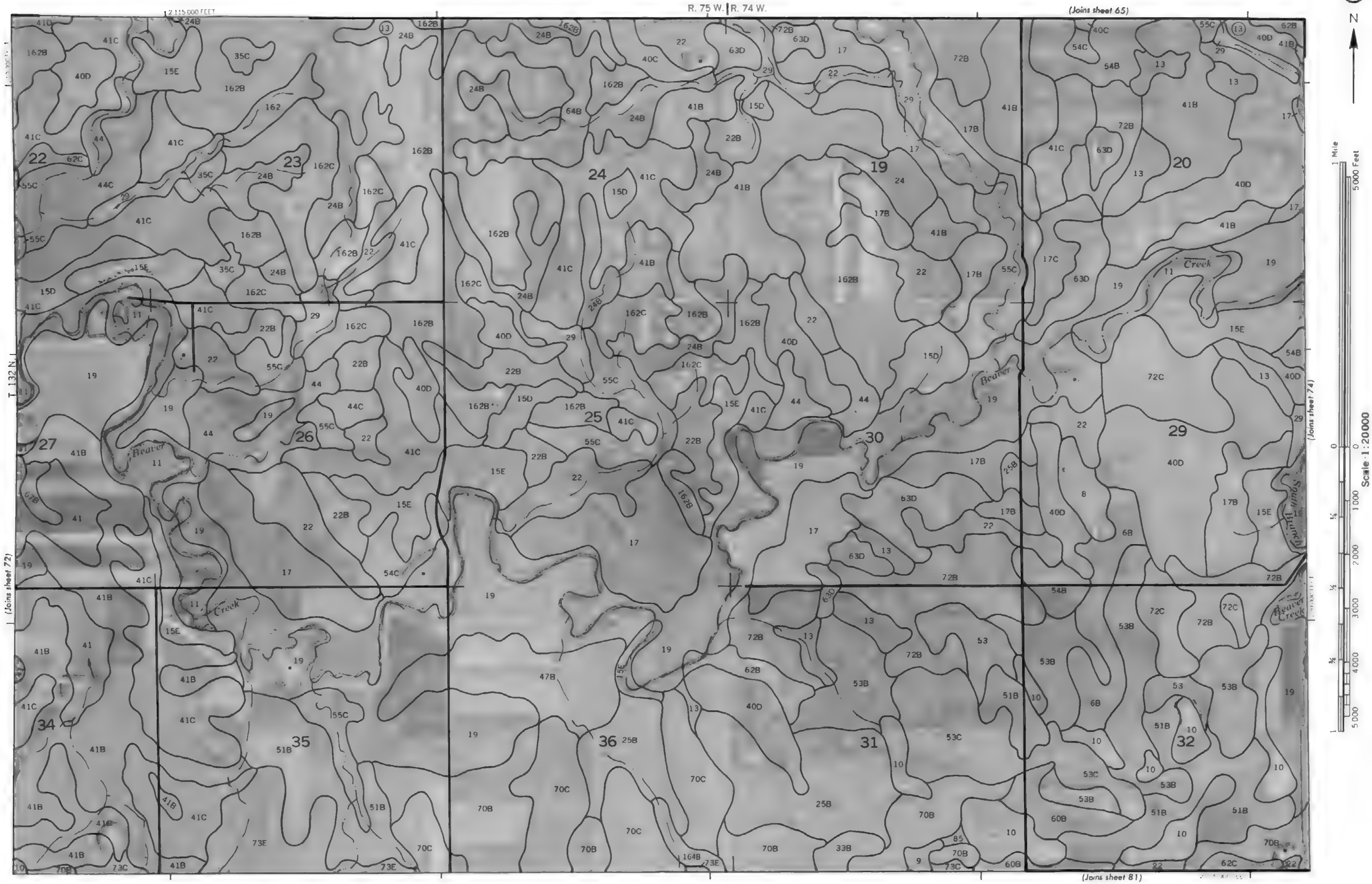

R. 78 W
R. 77 W
(Joins sheet 61)
(Joins sheet 68)
(Joins sheet 70)
(Joins sheet 77)
T. 132 N.
N
1 Mile
5000 Feet
Scale 1:20000
water

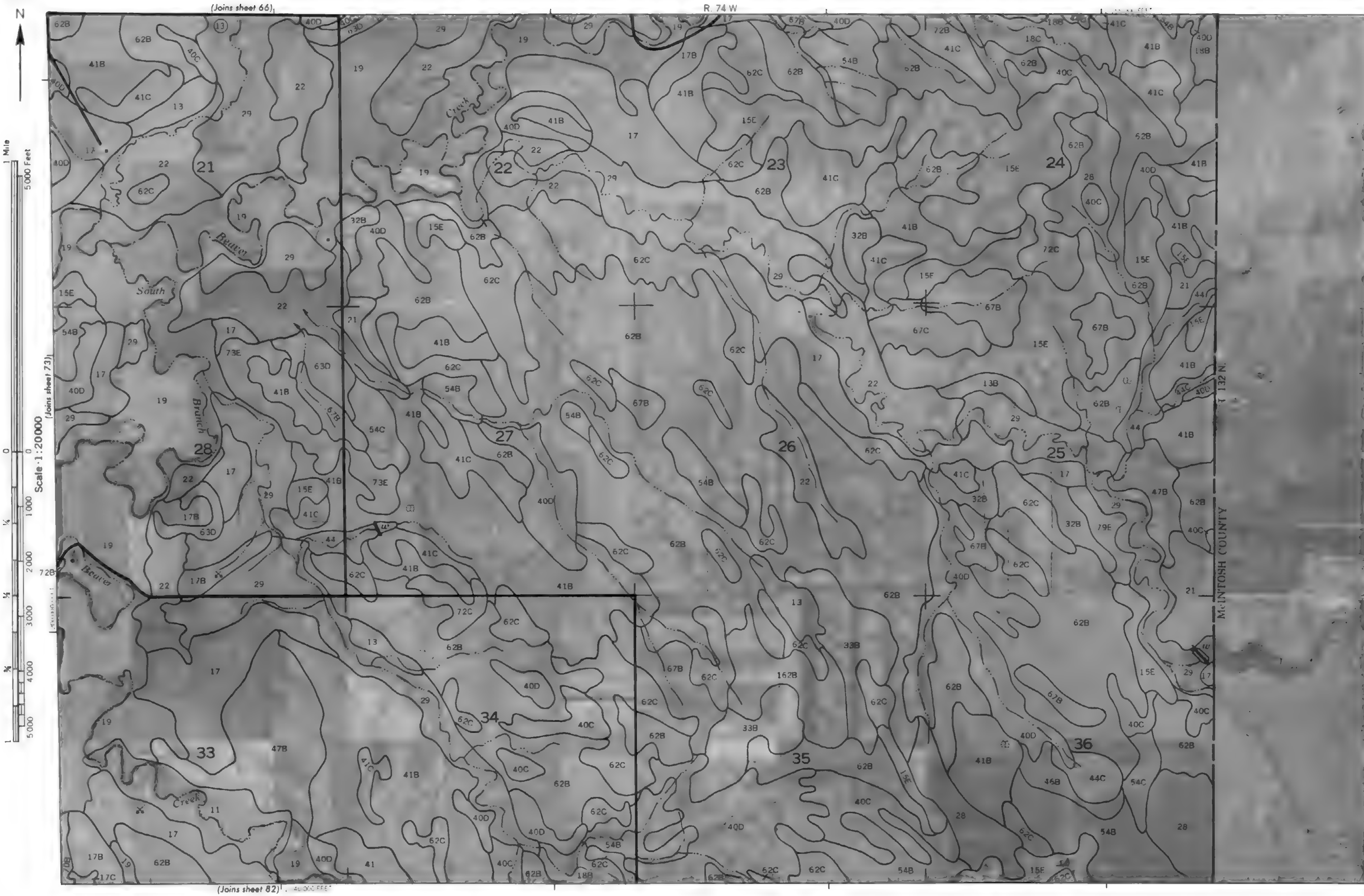

N
(Joins sheet 62)
R. 77 W.
R. 76 W.
2 065 000 FEET
T. 132 N.
(Joins sheet 69)
(Joins sheet 71)
(Joins sheet 78)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
water
19
21
22
23
24
25
26
27
28
30
31
33
34
35
36
17B
17C
29
31
32B
32C
33B
47B
46C
82
13
9
22
63D
63B
66C
66E
73C
73E
21B
49B
17
19
28
59

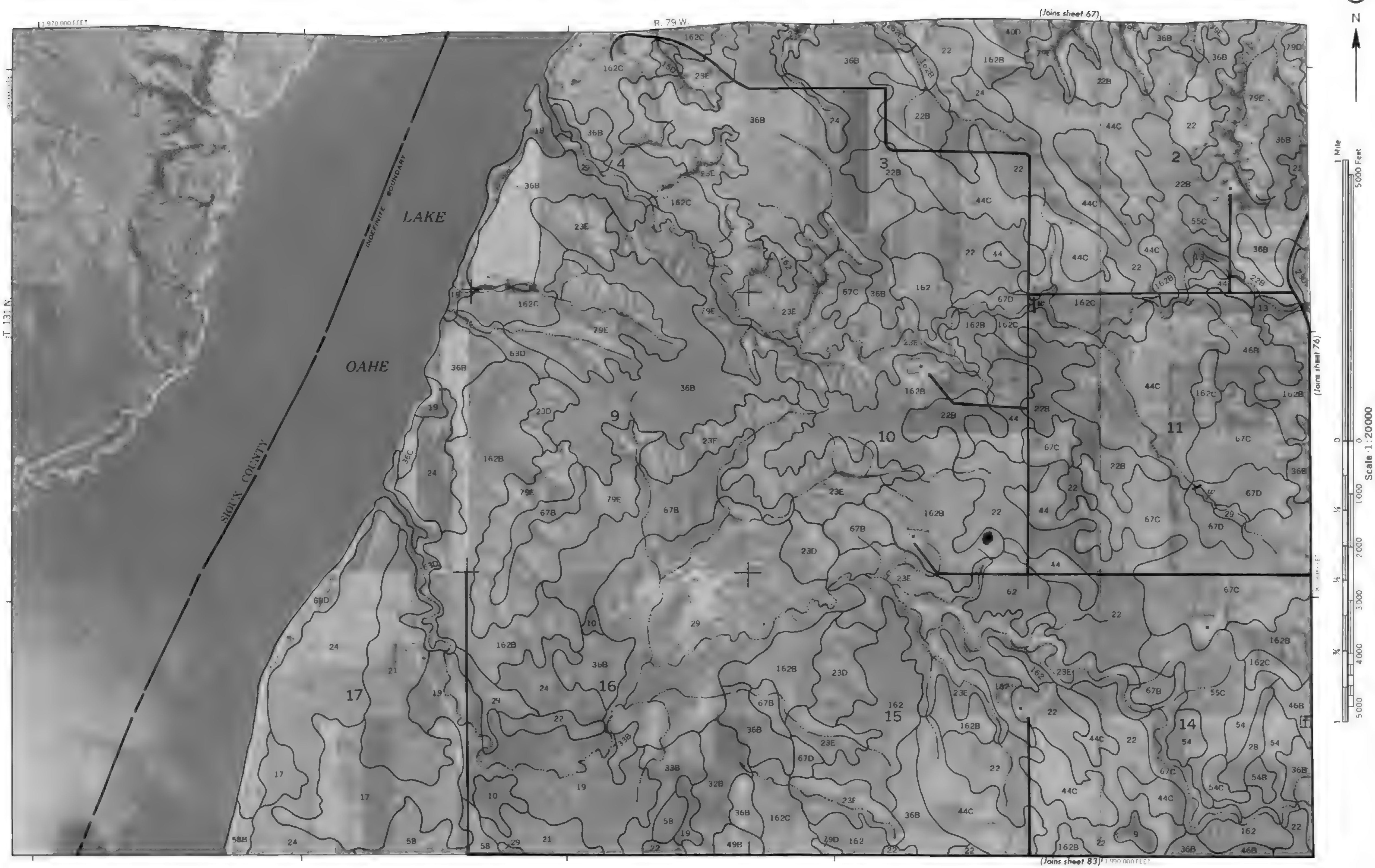
71

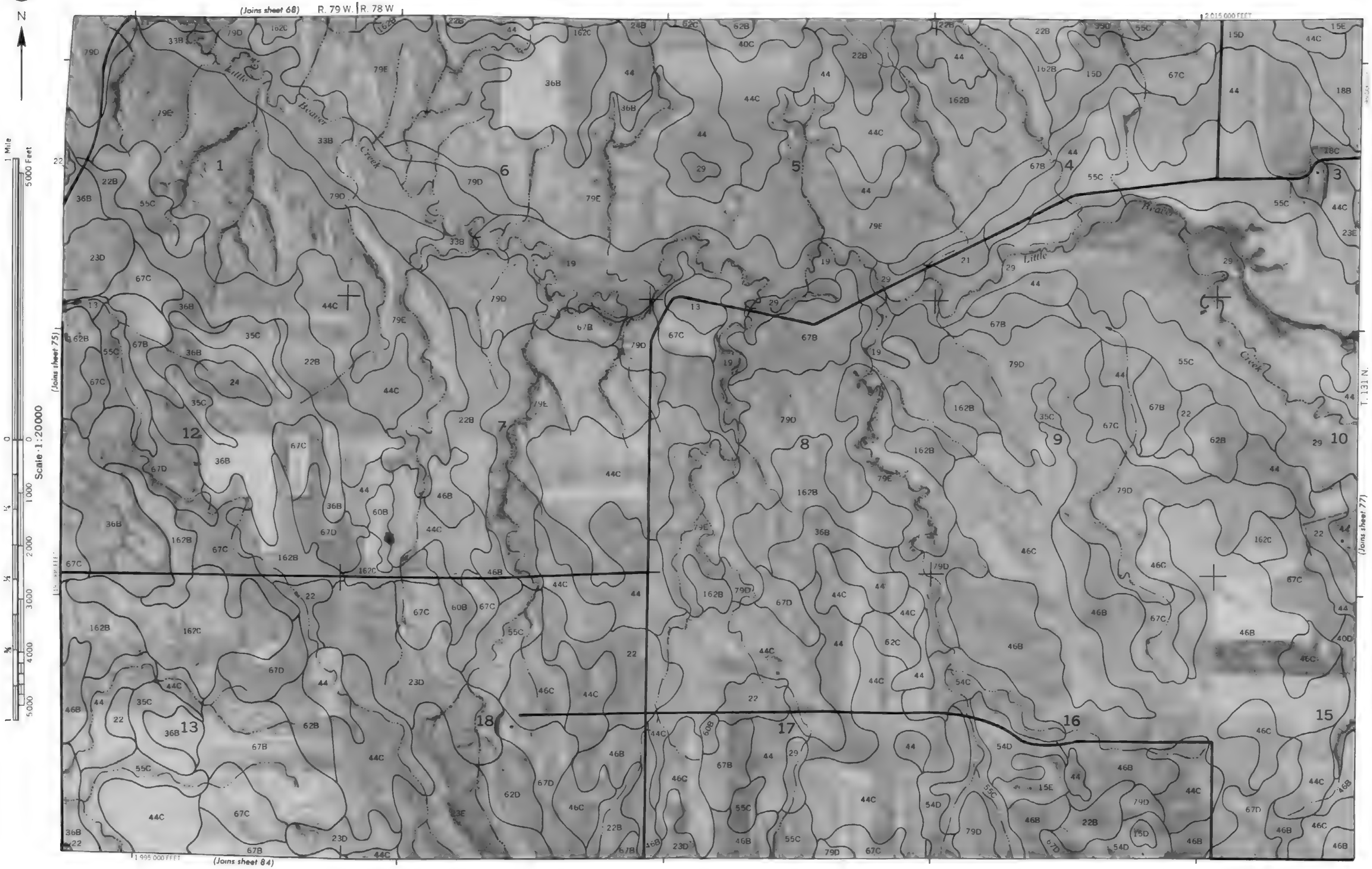

R. 76 W.
(Joins sheet 63)
(Joins sheet 72)
(Joins sheet 79)
(Joins sheet 70)
T. 132 N.
N
CHICAGO
MILWAUKEE
ST. PAUL
AND
PACIFIC
Beaver Creek
83
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000

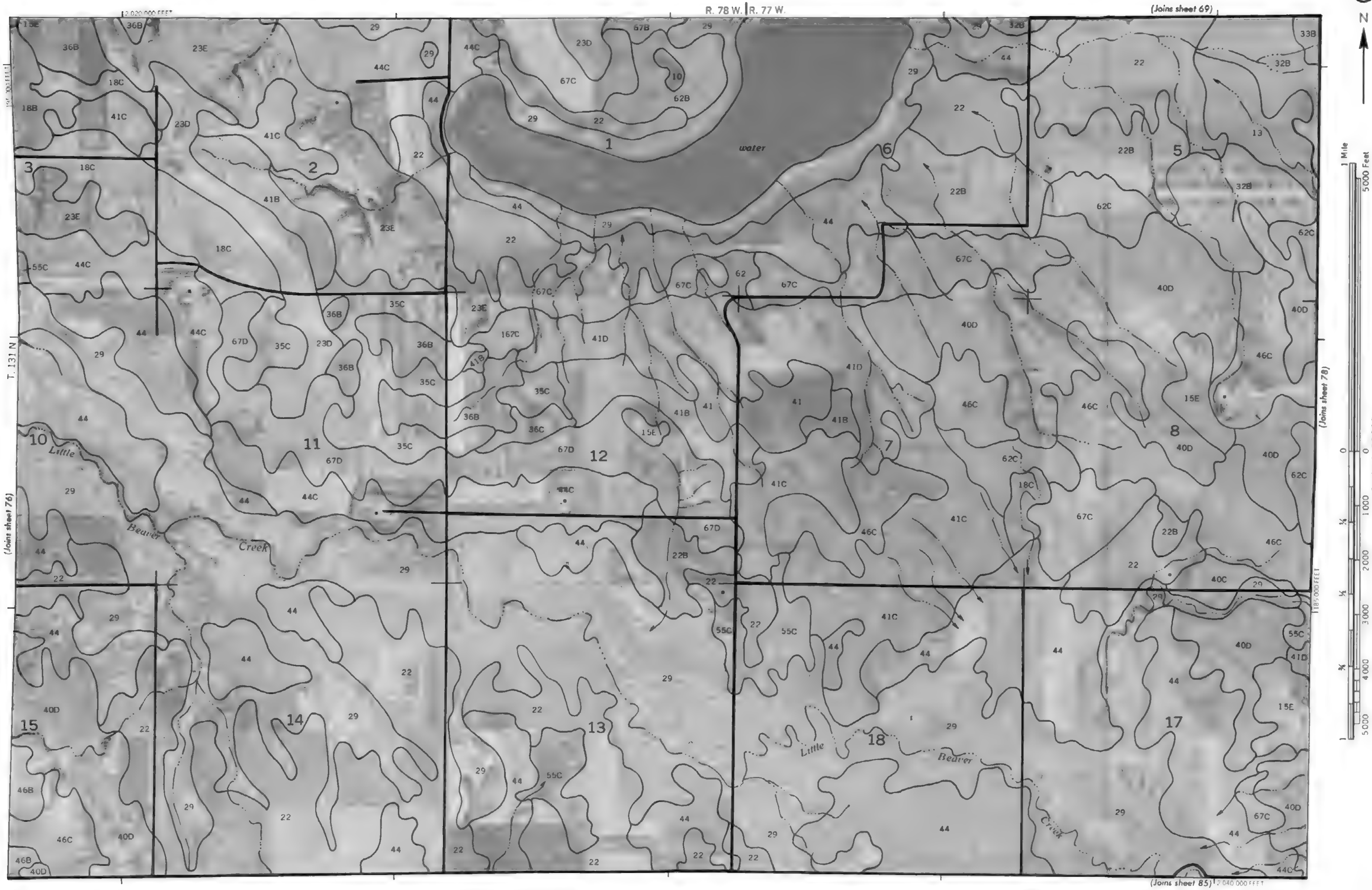

N
(Joins sheet 64)
R 76 W | R 75 W
(Joins sheet 71)
(Joins sheet 73)
(Joins sheet 80)
T. 132 N.
1 Mile
5000 Feet
Scale 1:20000
Beaver Creek
24
19
20
21
22
25
30
29
28
27
36
31
32
33
34

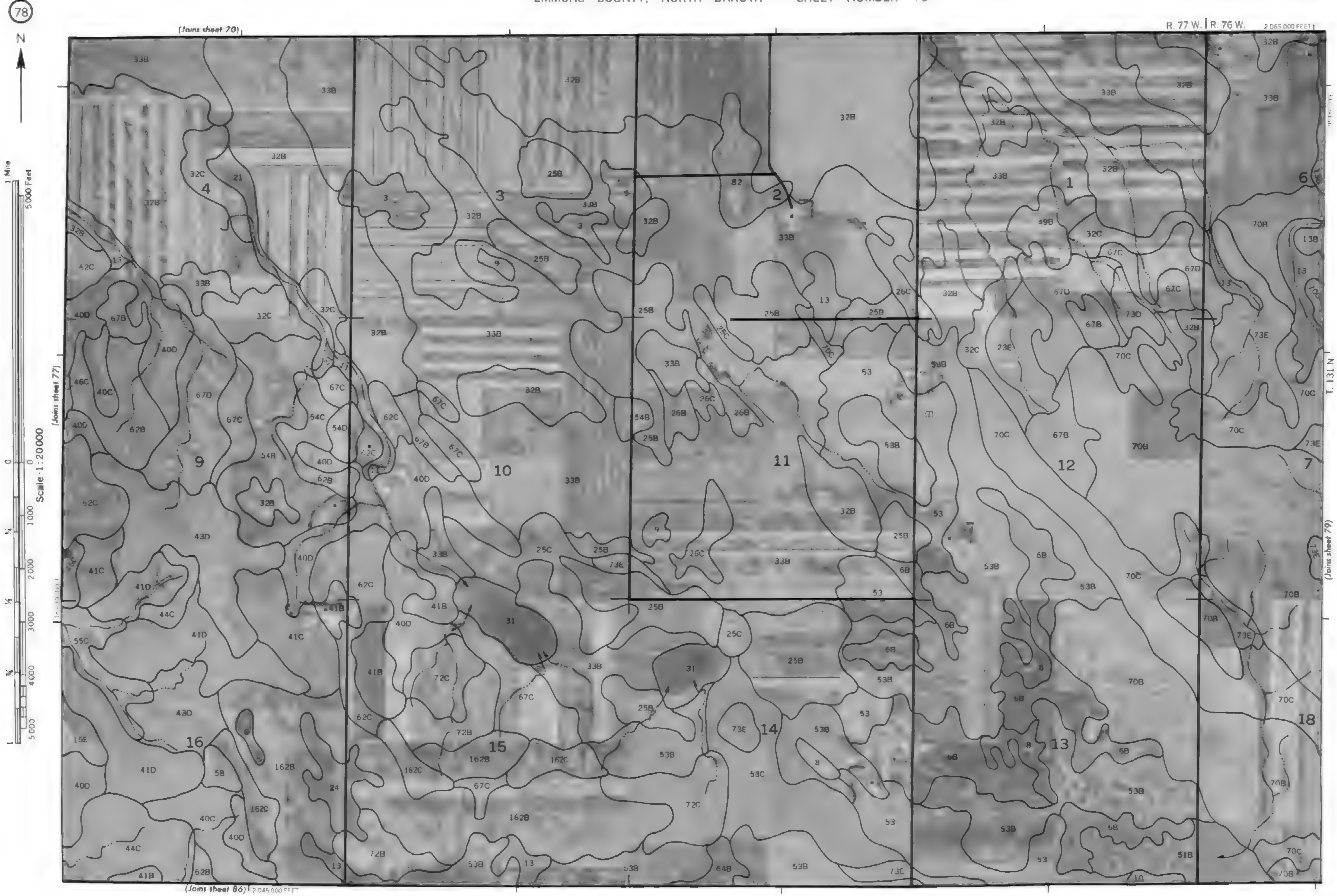

2 115 000 FEET
R. 75 W. | R. 74 W.
(Joins sheet 65)
(Joins sheet 72)
(Joins sheet 74)
(Joins sheet 81)
T. 132 N.
N
Beaver Creek
South Branch
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
1 Mile
5000 Feet
Scale 1:20000

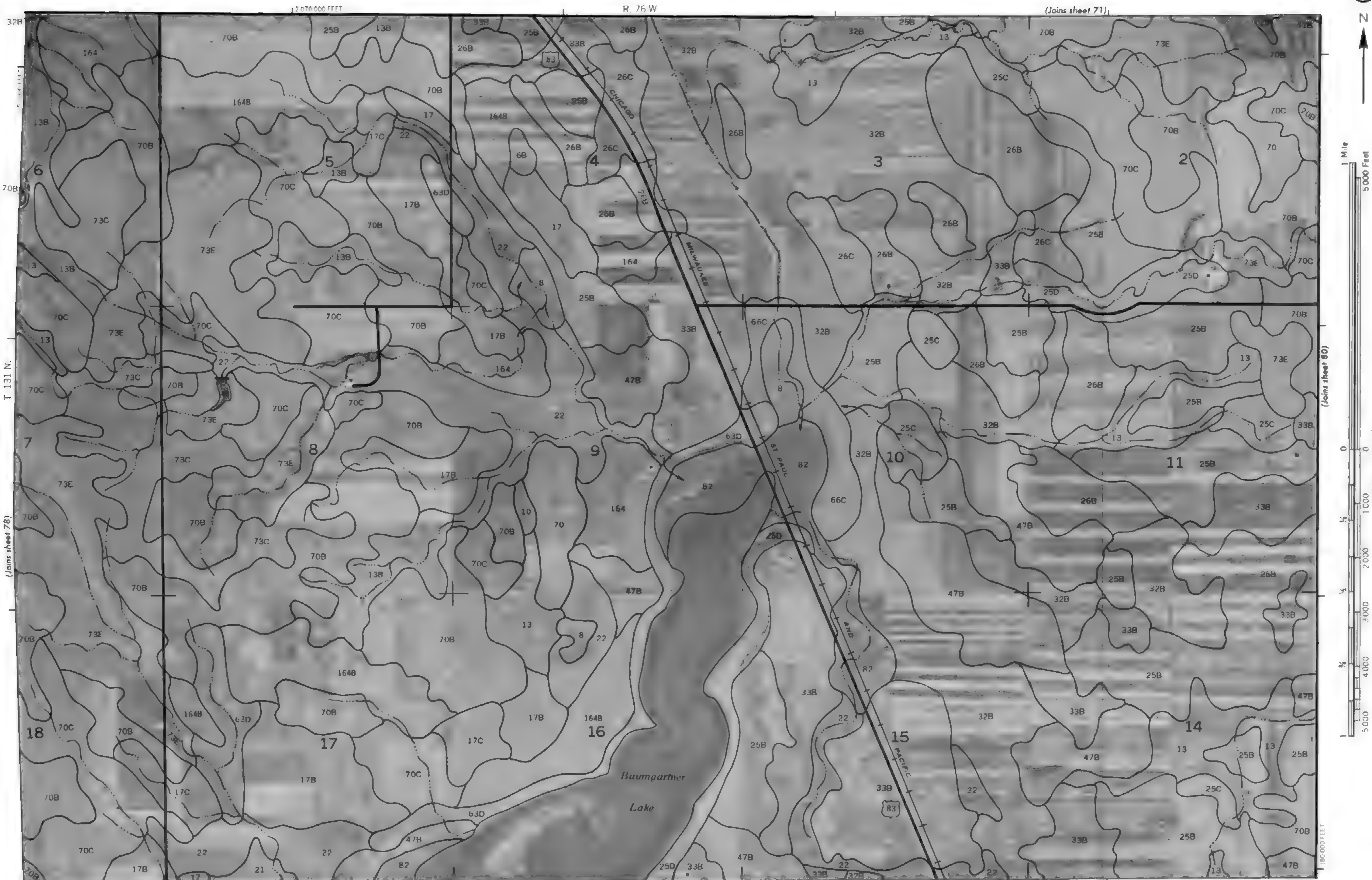

N
(Joins sheet 66)
R. 74 W
(Joins sheet 73)
(Joins sheet 82)
T. 132 N.
McINTOSH COUNTY
Scale 1:20000
1 Mile
5000 Feet
South
Beaver
Branch
Beaver
Creek
Creek
21
22
23
24
25
26
27
28
33
34
35
36


75
N
(Joins sheet 67)
(Joins sheet 76)
(Joins sheet 83)
R. 79 W.
T. 131 N.
LAKE
OAHE
SIOUX COUNTY
INDEFINITE BOUNDARY
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
2
3
4
9
10
11
14
15
16
17

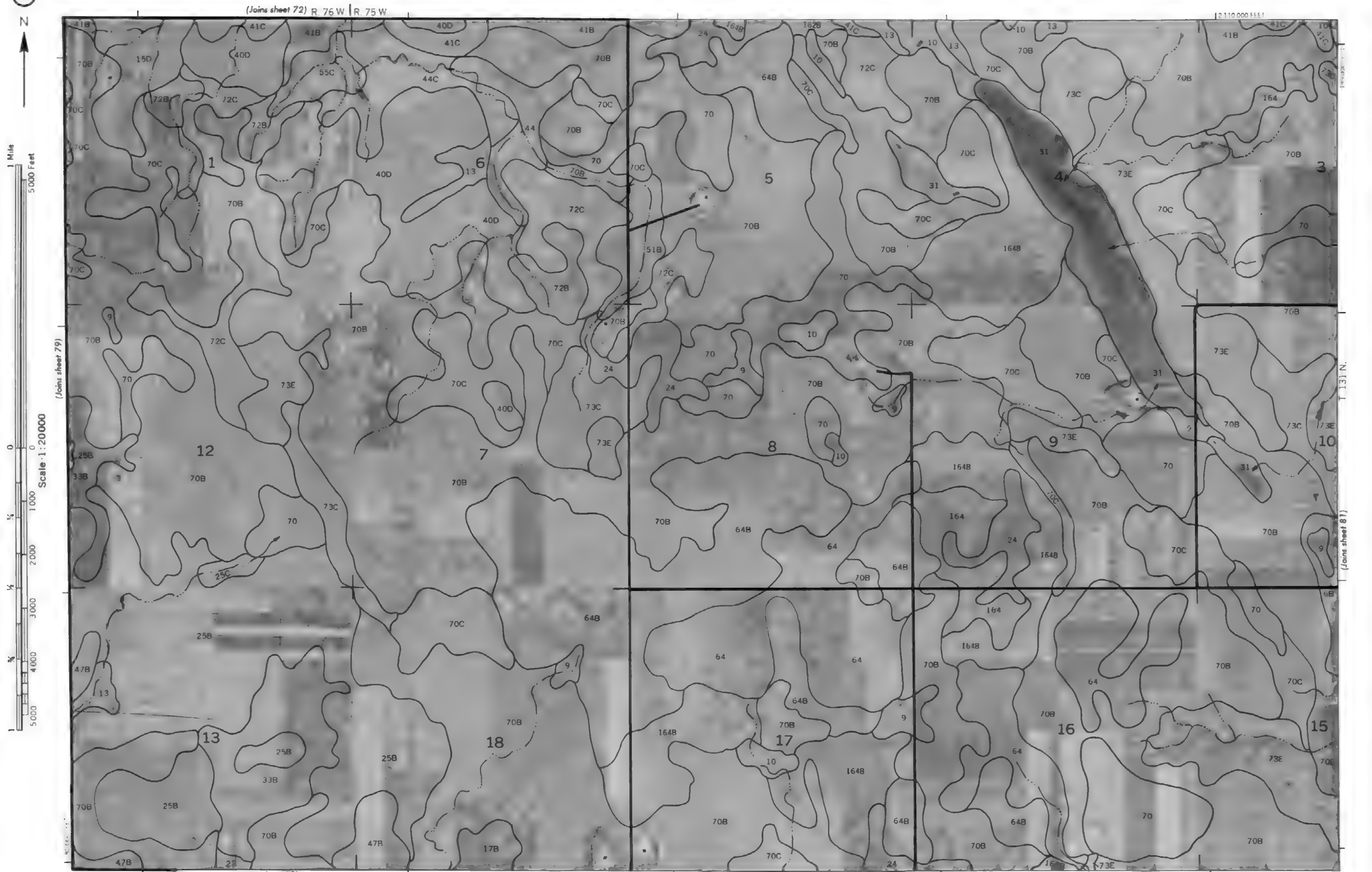

N
(Joins sheet 68)
R. 79 W.
R. 78 W
2 015 000 FEET
(Joins sheet 75)
(Joins sheet 77)
(Joins sheet 84)
T. 131 N.
1 995 000 FEET
Little Beaver Creek
Little Beaver Creek
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000

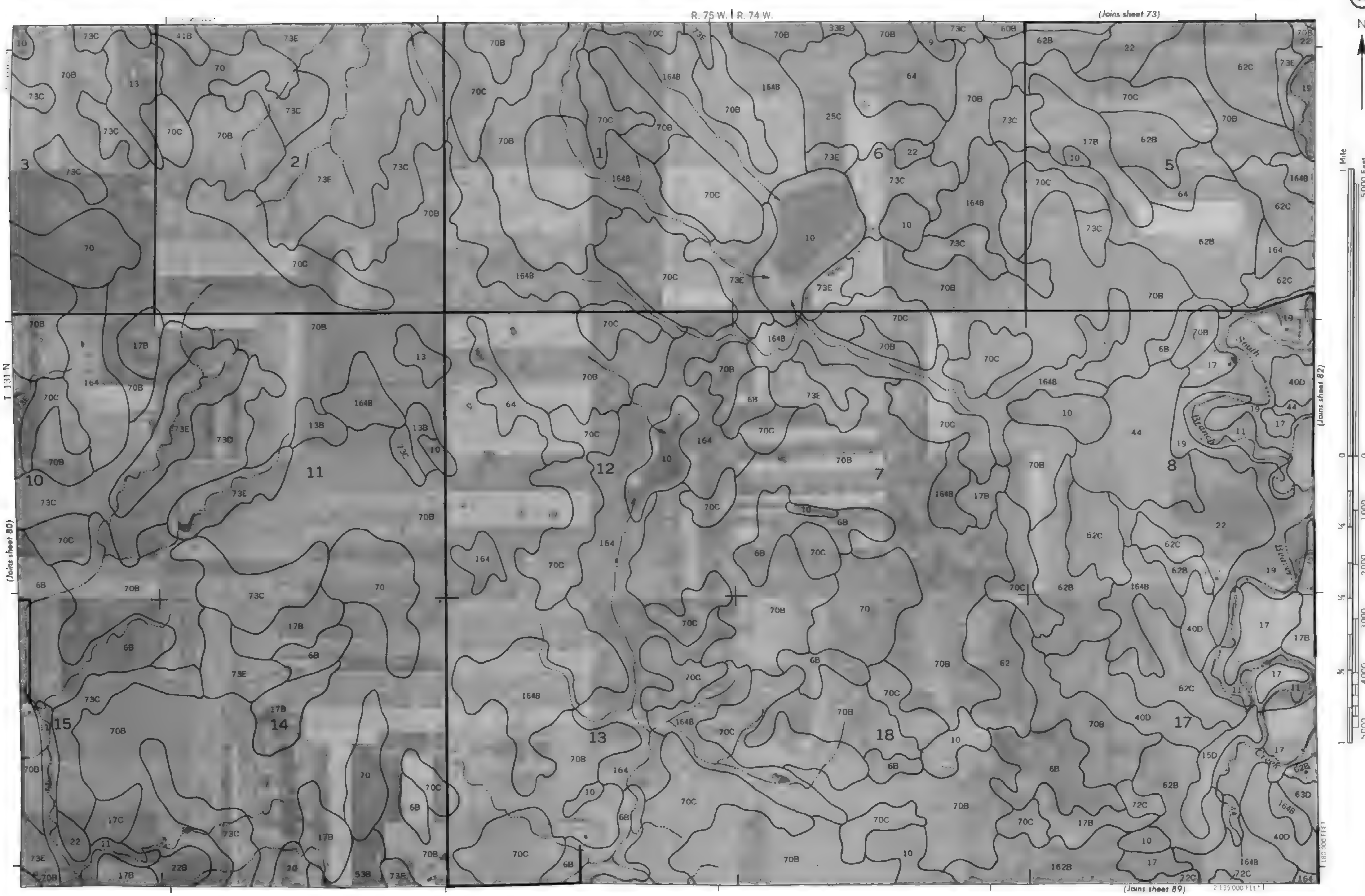

R. 78 W. | R. 77 W.
(Joins sheet 69)
(Joins sheet 76)
(Joins sheet 78)
(Joins sheet 85)
T. 131 N.
water
Little Beaver Creek
N
Scale 1:20000
1 Mile
5000 Feet

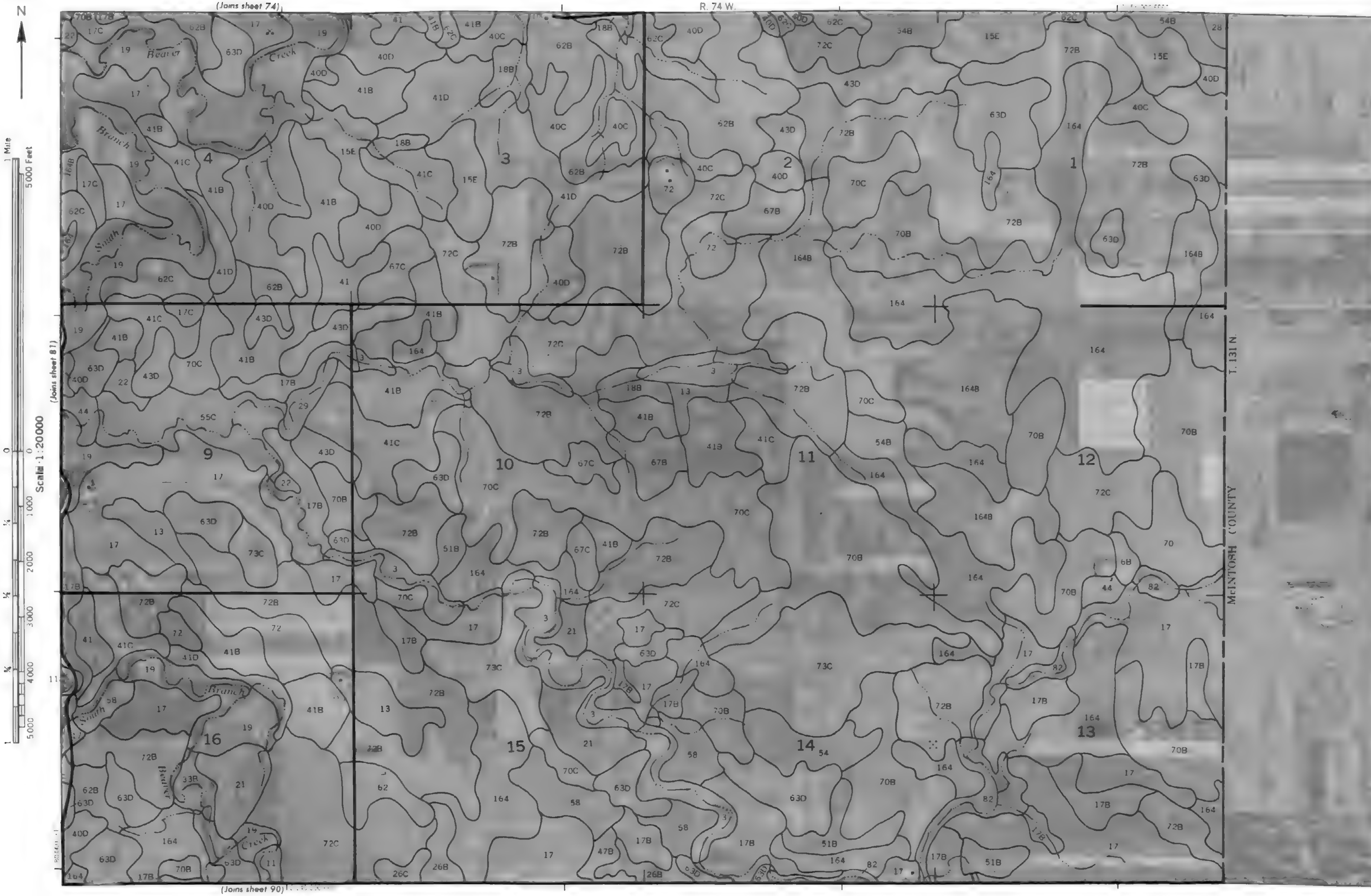

78
N
(Joins sheet 70)
R. 77 W.
R. 76 W.
2 065 000 FEET
T. 131 N
(Joins sheet 77)
(Joins sheet 79)
(Joins sheet 86)
2 045 000 FEET
1 Mile
5000 Feet
Scale 1:20000

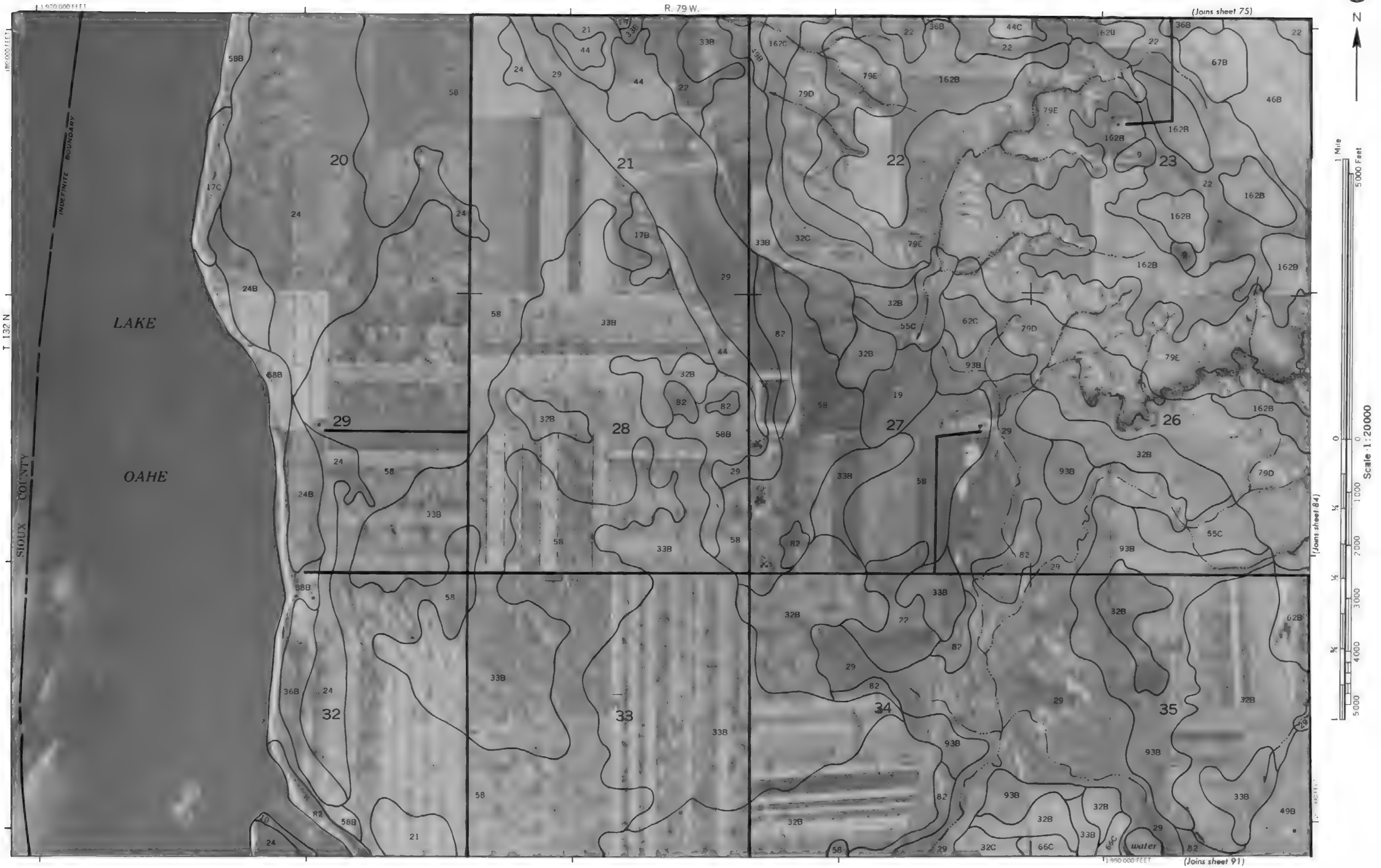


2 070 000 FEET
R. 76 W
(Joins sheet 71)
(Joins sheet 80)
(Joins sheet 87)
(Joins sheet 78)
T. 131 N.
N
CHICAGO
MILWAUKEE
ST PAUL
AND
PACIFIC
83
Baumgartner
Lake
1 Mile
5000 Feet
Scale 1:20000

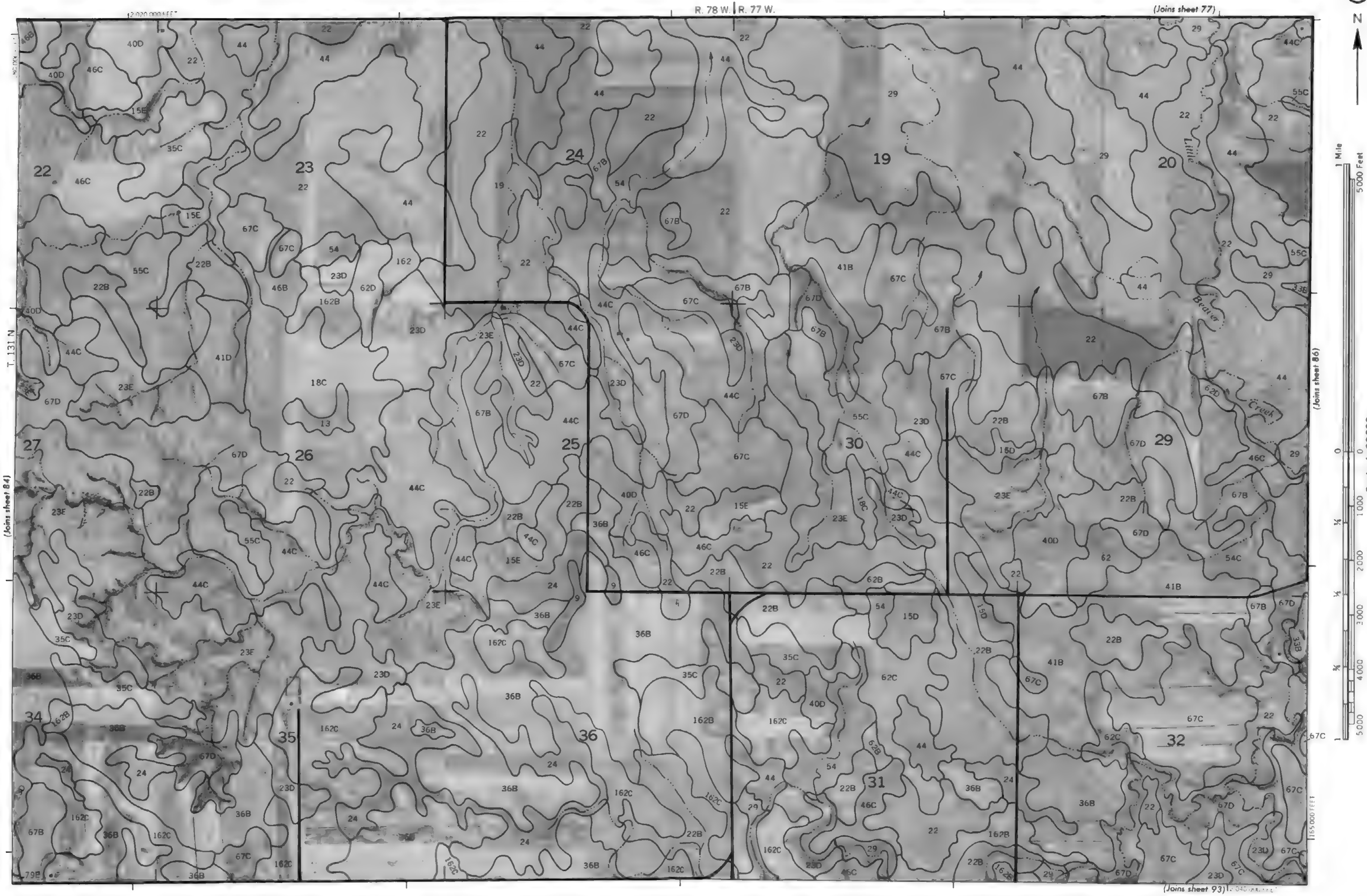

N
(Joins sheet 72)
R. 76 W.
R. 75 W.
(Joins sheet 79)
(Joins sheet 81)
(Joins sheet 88)
T. 131 N.
2 110 000 FEET
1 Mile
5000 Feet
Scale 1:20000
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18
41B
41C
40D
40C
70B
15D
55C
44C
72B
72C
70C
64B
73C
73E
164
164B
31
24
51B
25B
33B
47B
17B
25C
64
70

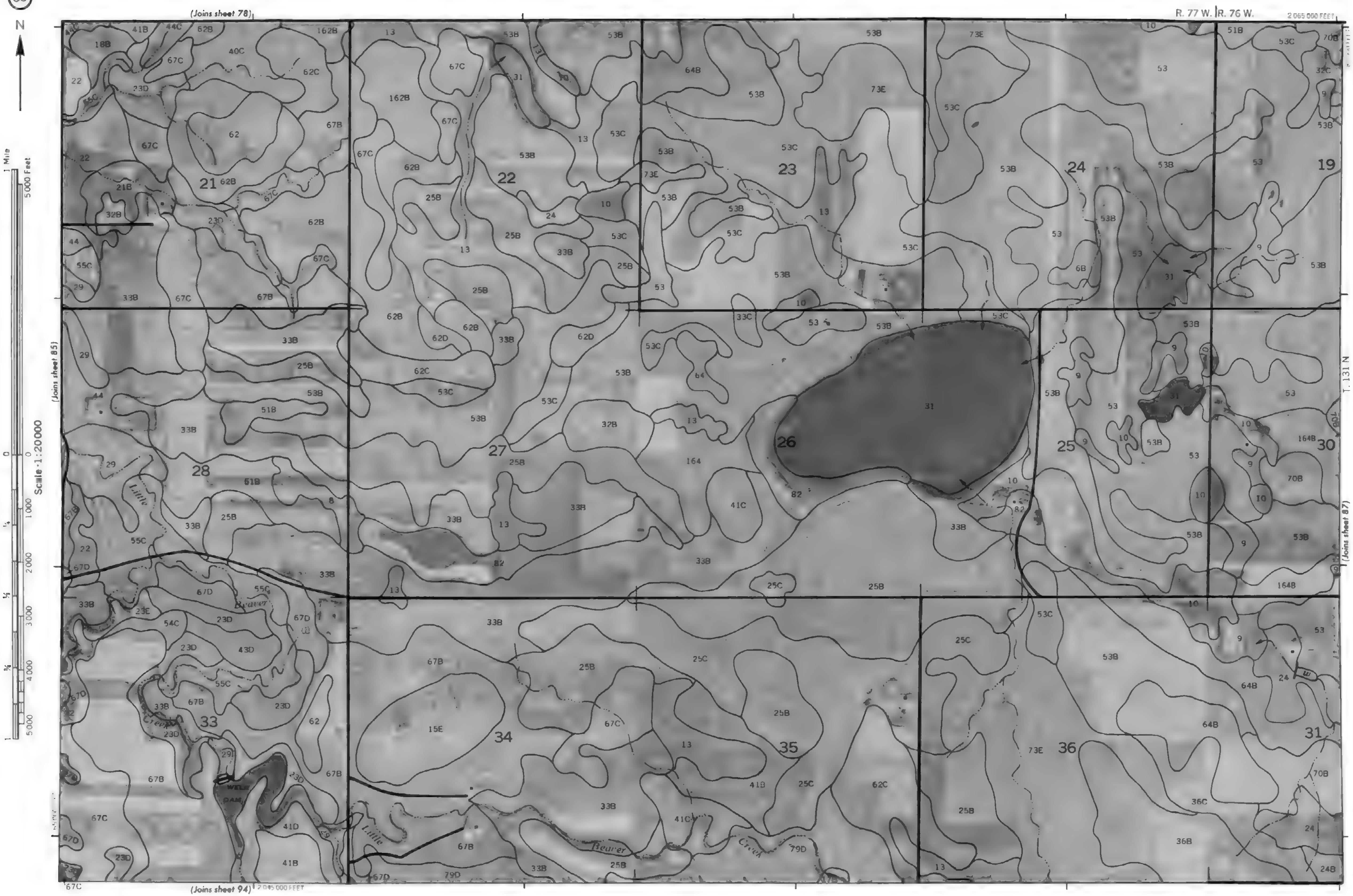

81
N
R. 75 W. | R. 74 W.
(Joins sheet 73)
(Joins sheet 82)
(Joins sheet 89)
(Joins sheet 80)
T. 131 N.
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18
South Branch
Beaver Creek

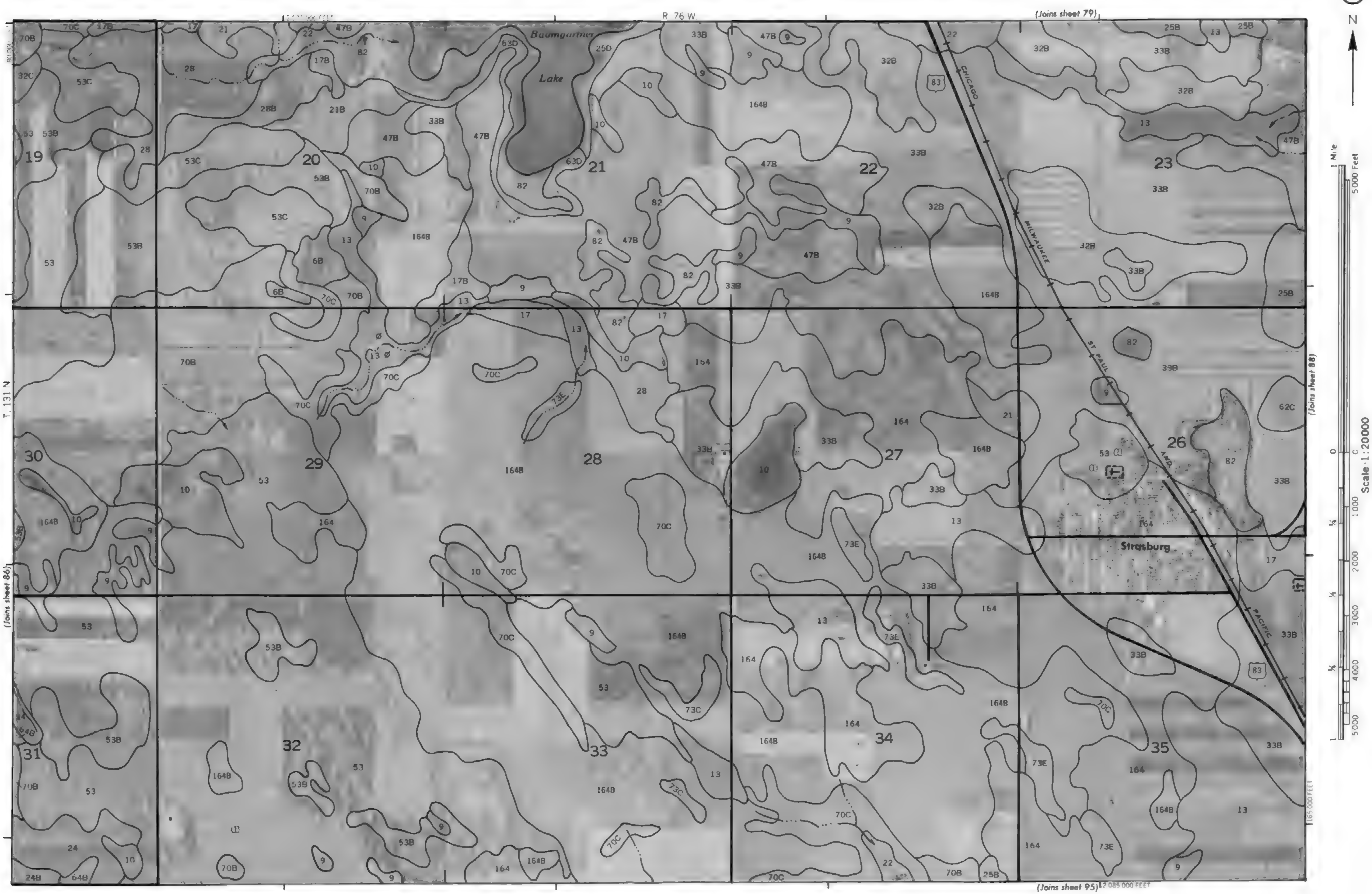

N
(Joins sheet 74)
R. 74 W.
(Joins sheet 81)
(Joins sheet 90)
T. 131 N.
McINTOSH COUNTY
Scale 1:20000
1 Mile
5000 Feet
Beaver Creek
South Branch
Beaver Creek
South Branch

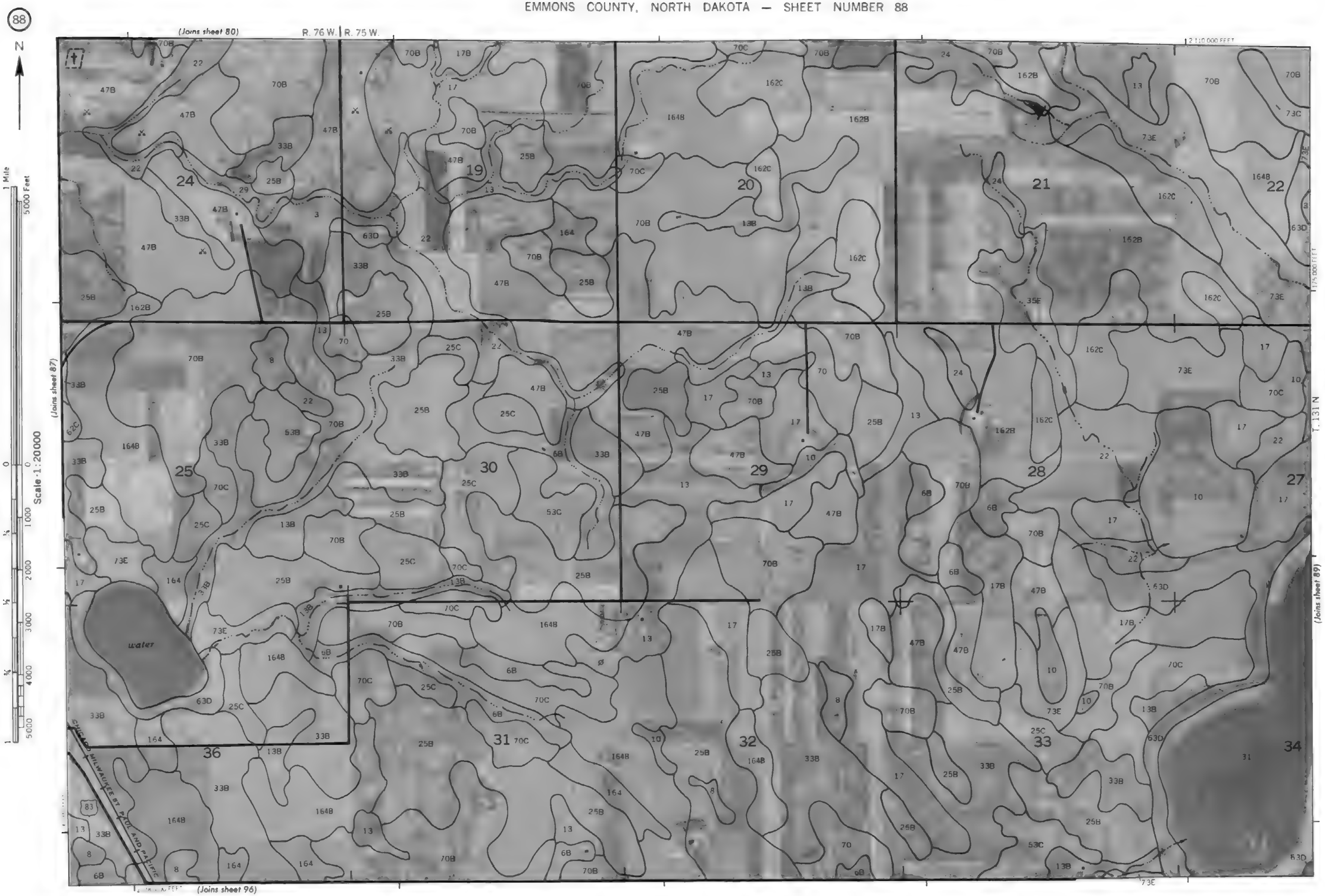

83
N
R. 79 W.
(Joins sheet 75)
(Joins sheet 84)
(Joins sheet 91)
T 132 N
LAKE
OAHE
SIOUX COUNTY
INDEFINITE BOUNDARY
20
21
22
23
26
27
28
29
32
33
34
35
water
1 Mile
5000 Feet
Scale 1:20000
1 970 000 FEET
1 990 000 FEET


84
N
(Joins sheet 76)
R. 79 W. | R. 78 W.
(Joins sheet 83)
(Joins sheet 85)
(Joins sheet 92)
T. 131 N.
1 Mile
5000 Feet
Scale 1:20000
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36

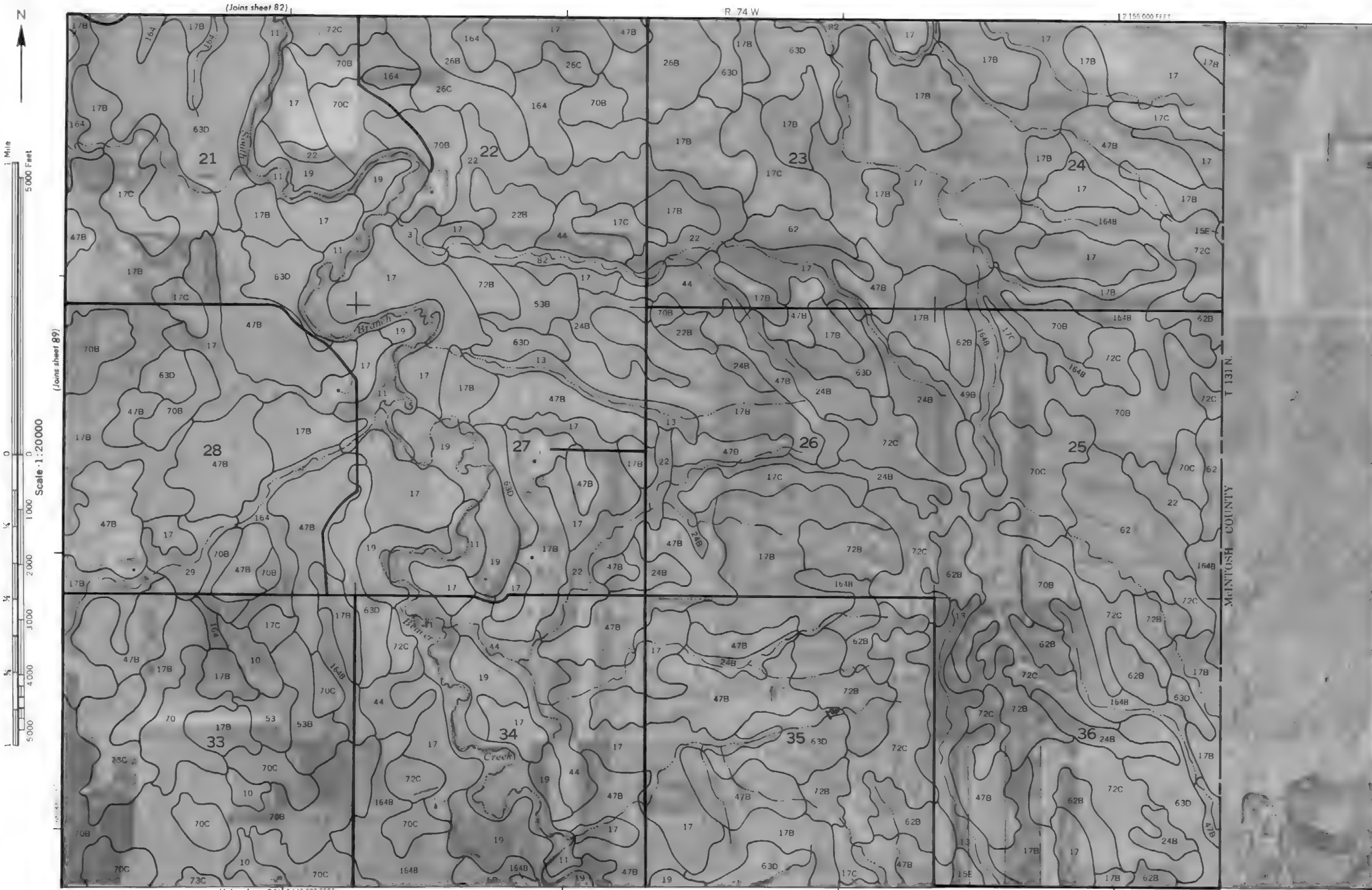

85
N
R. 78 W. | R. 77 W.
(Joins sheet 77)
(Joins sheet 86)
(Joins sheet 84)
(Joins sheet 93)
T. 131 N.
Little Beaver Creek
1 Mile
5000 Feet
Scale 1:20000
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36


86
N
(Joins sheet 78)
R. 77 W. | R. 76 W.
2 065 000 FEET
(Joins sheet 85)
(Joins sheet 87)
(Joins sheet 94)
2 045 000 FEET
T. 131 N.
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
Little Beaver Creek
WELK DAM

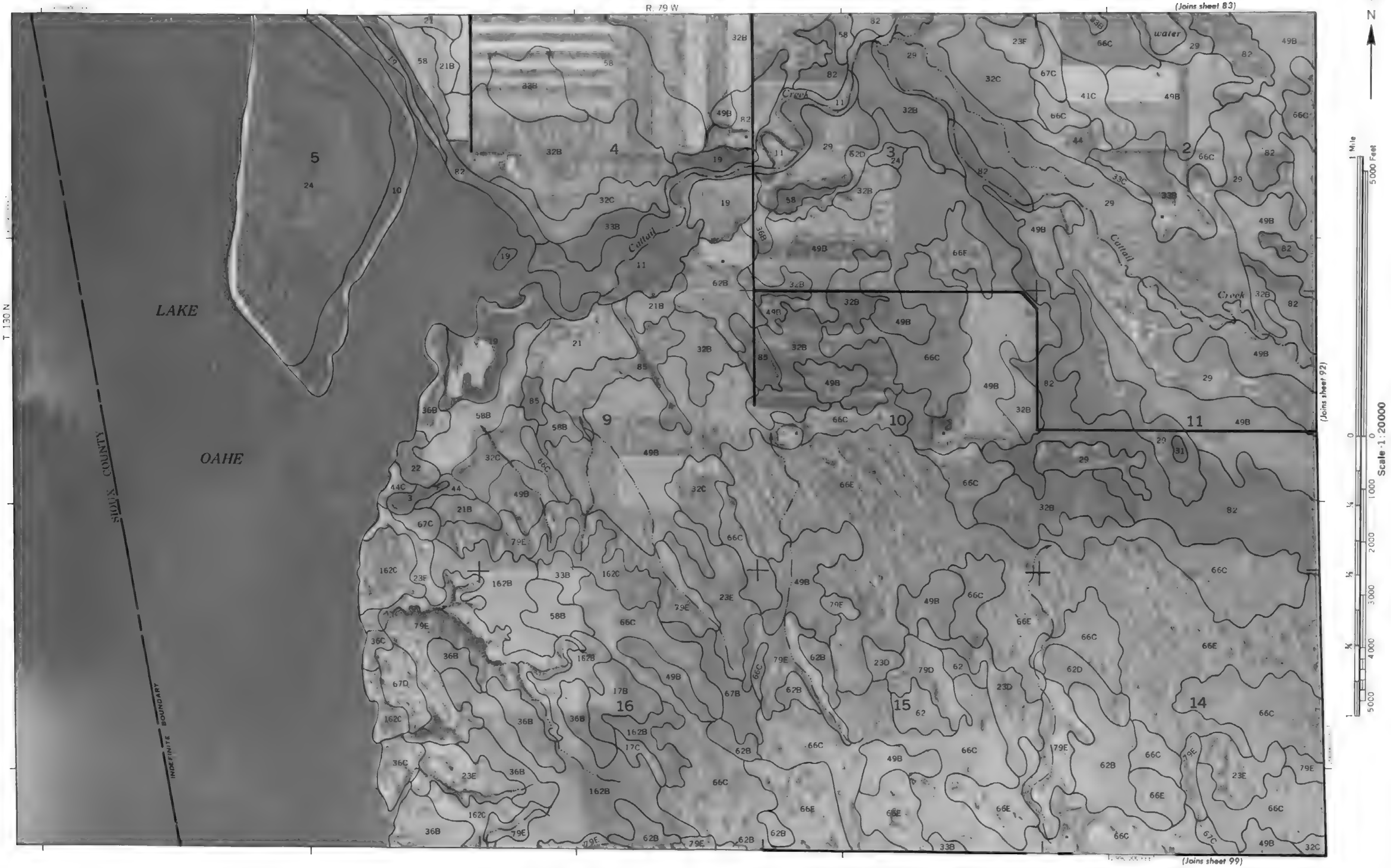

R. 76 W.
(Joins sheet 79)
(Joins sheet 88)
(Joins sheet 95)
(Joins sheet 86)
T. 131 N.
Baumgartner
Lake
Strasburg
CHICAGO
MILWAUKEE
ST PAUL
AND
PACIFIC
83
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
N
1 Mile
5000 Feet
Scale 1:20000
2 085 000 FEET
165 000 FEET

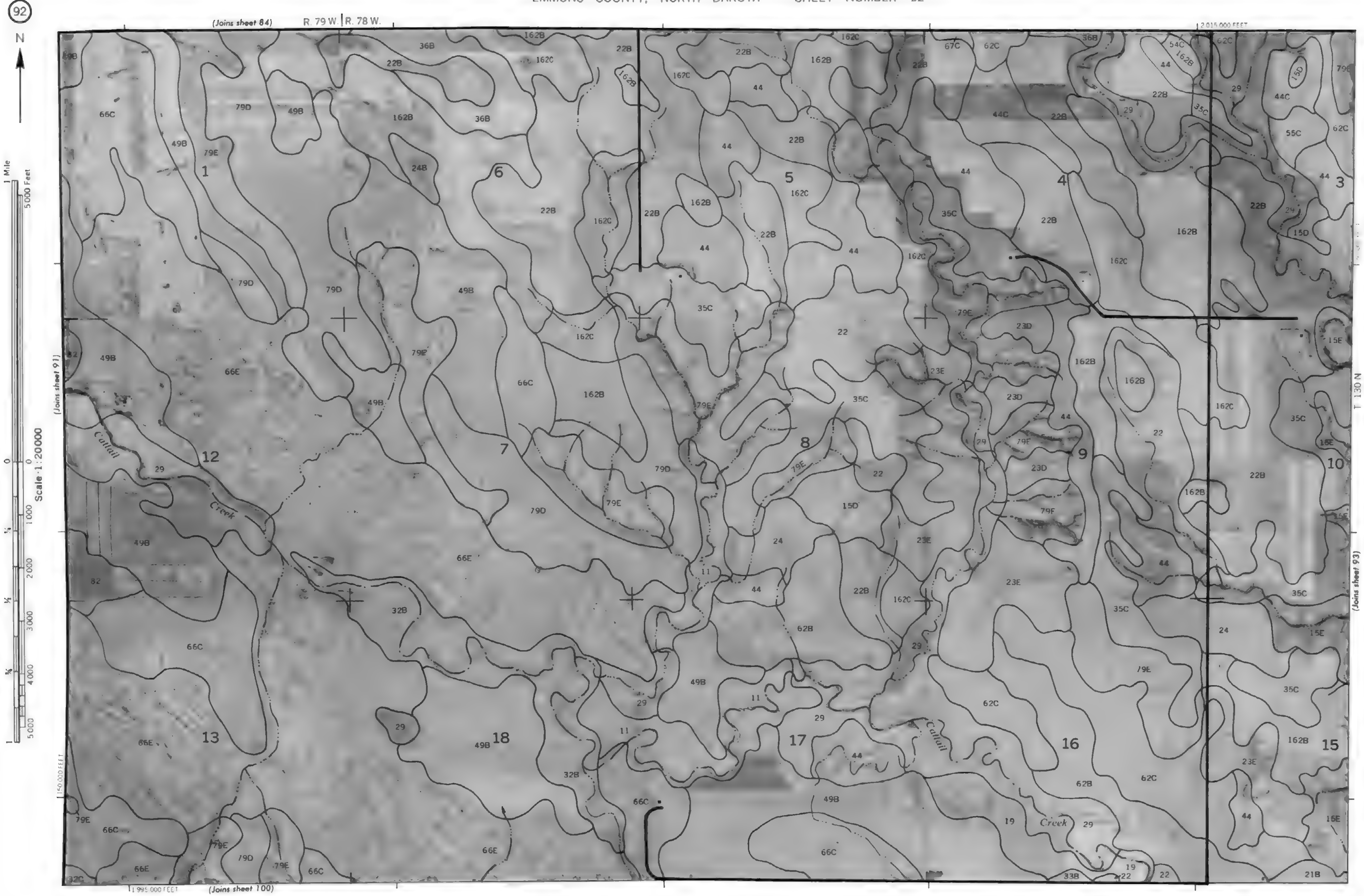

88
N
(Joins sheet 80)
R. 76 W.
R. 75 W.
2 110 000 FEET
175 000 FEET
T. 131 N.
(Joins sheet 87)
(Joins sheet 89)
(Joins sheet 96)
1 Mile
5000 Feet
Scale 1:20000
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
water
83
CHICAGO MILWAUKEE ST PAUL AND PACIFIC

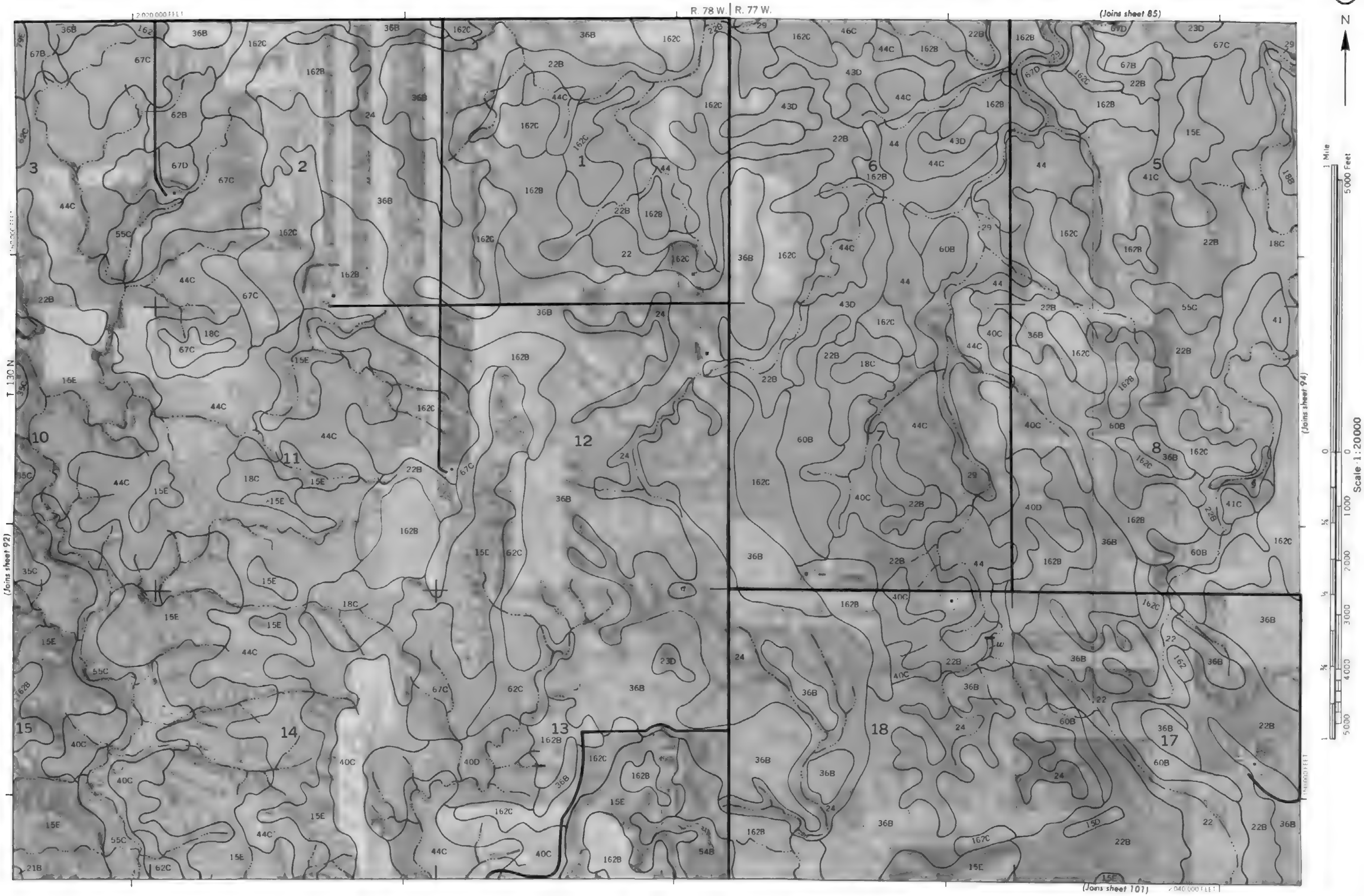

R. 75 W.
R. 74 W.
(Joins sheet 81)
T. 131 N.
(Joins sheet 88)
(Joins sheet 90)
(Joins sheet 97)
N
1 Mile
5000 Feet
Scale 1:20000
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32

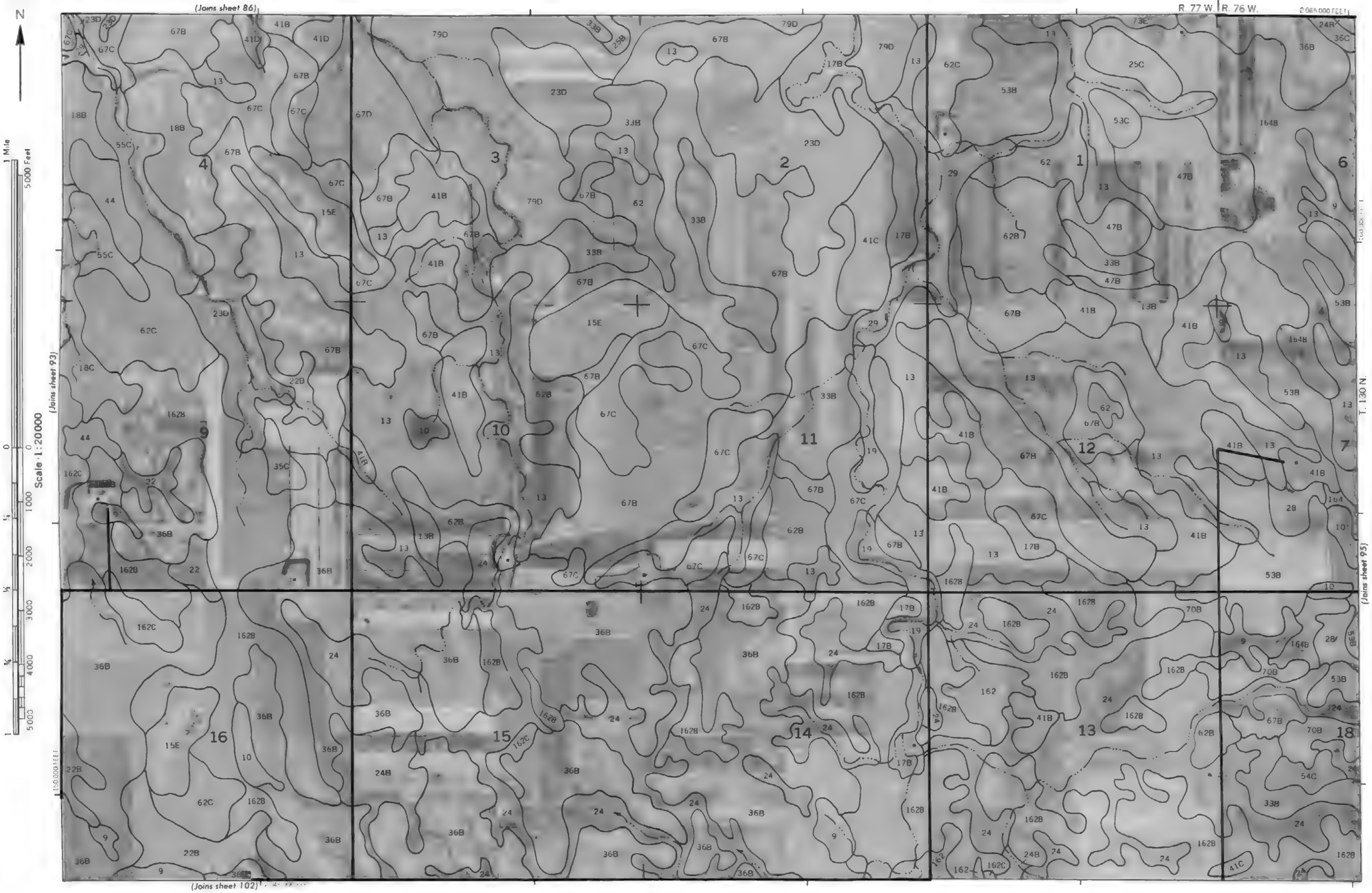

N
1 Mile
5 000 Feet
Scale 1:20000
0
1 000
2 000
3 000
4 000
5 000
(Joins sheet 82)
R. 74 W.
2 155 000 FEET
(Joins sheet 89)
(Joins sheet 98)
2 140 000 FEET
T. 131 N.
McINTOSH COUNTY
South Branch
Beaver Creek
21
22
23
24
25
26
27
28
33
34
35
36

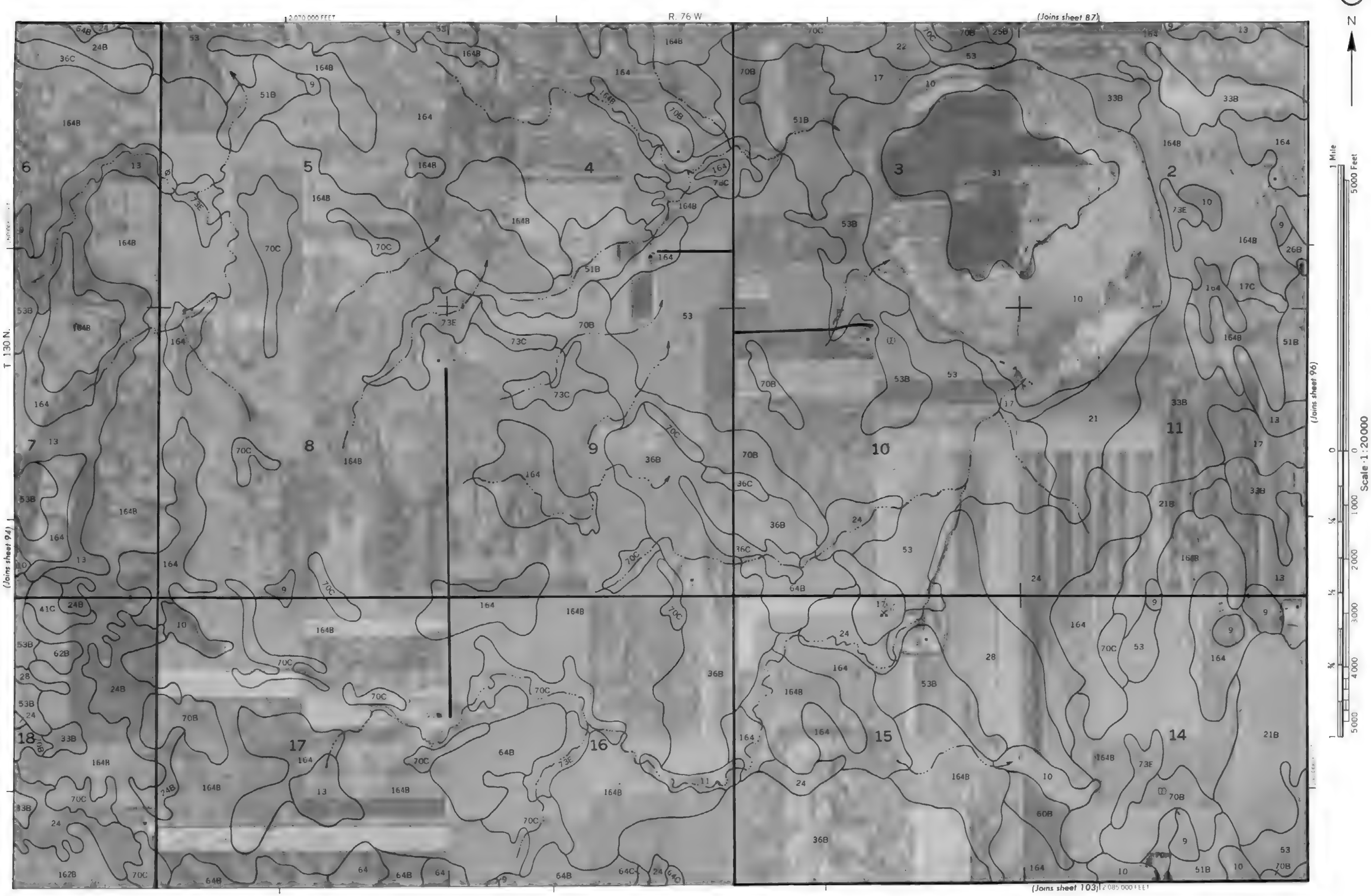
91

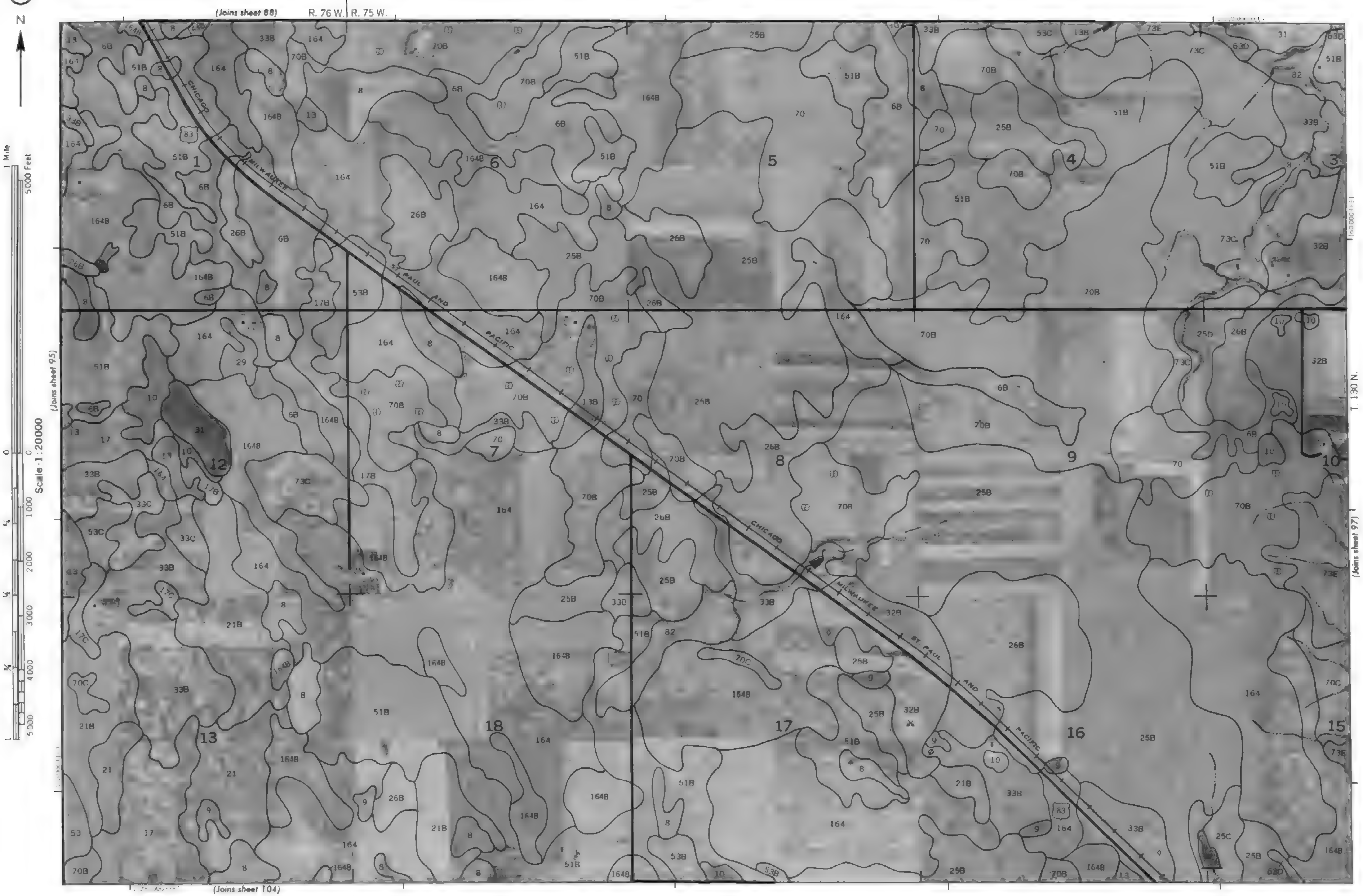

R. 79 W.
(Joins sheet 83)
(Joins sheet 92)
(Joins sheet 99)
T. 130 N.
N
LAKE
OAHE
SIOUX COUNTY
INDEFINITE BOUNDARY
Cattail
Creek
water
Scale 1:20000
1 Mile
5000 Feet
2
3
4
5
9
10
11
14
15
16

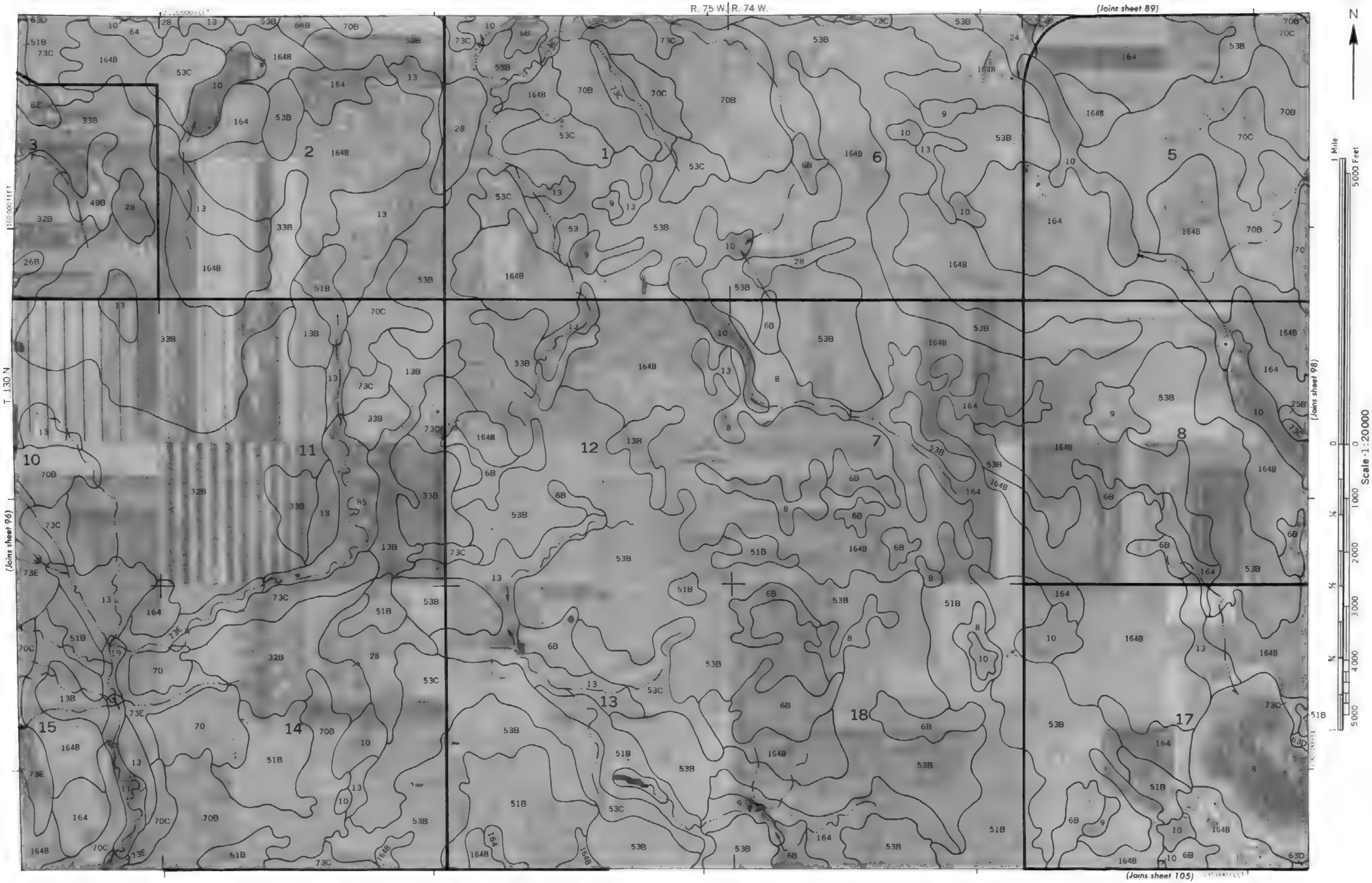

92
N
(Joins sheet 84)
R. 79 W. | R. 78 W.
2 015 000 FEET
(Joins sheet 91)
(Joins sheet 93)
T. 130 N.
(Joins sheet 100)
1 995 000 FEET
150 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
½
1
0
1000
2000
3000
4000
5000
Cattail Creek
Cattail
Creek
1
2
3
4
5
6
7
8
9
10
12
13
15
16
17
18
49B
66C
79D
79E
49B
36B
22B
162B
162C
24B
22B
162C
22B
44
5
162C
162B
22B
44
35C
22
67C
62C
36B
44C
22B
35C
162C
23D
23E
22B
162B
162C
54C
44
162B
29
35C
62C
79E
44C
55C
15D
15E
35C
16E
22B
24
15E
35C
162B
23E
44
16E
21B
22
19
33B
29
62B
62C
66C
49B
32B
66C
66E
79D
79E
82
29
32B
66E
79D
11
44
62B
49B
29
11
29
17
44
35C
79E
15D
23E
162C
22B
79F

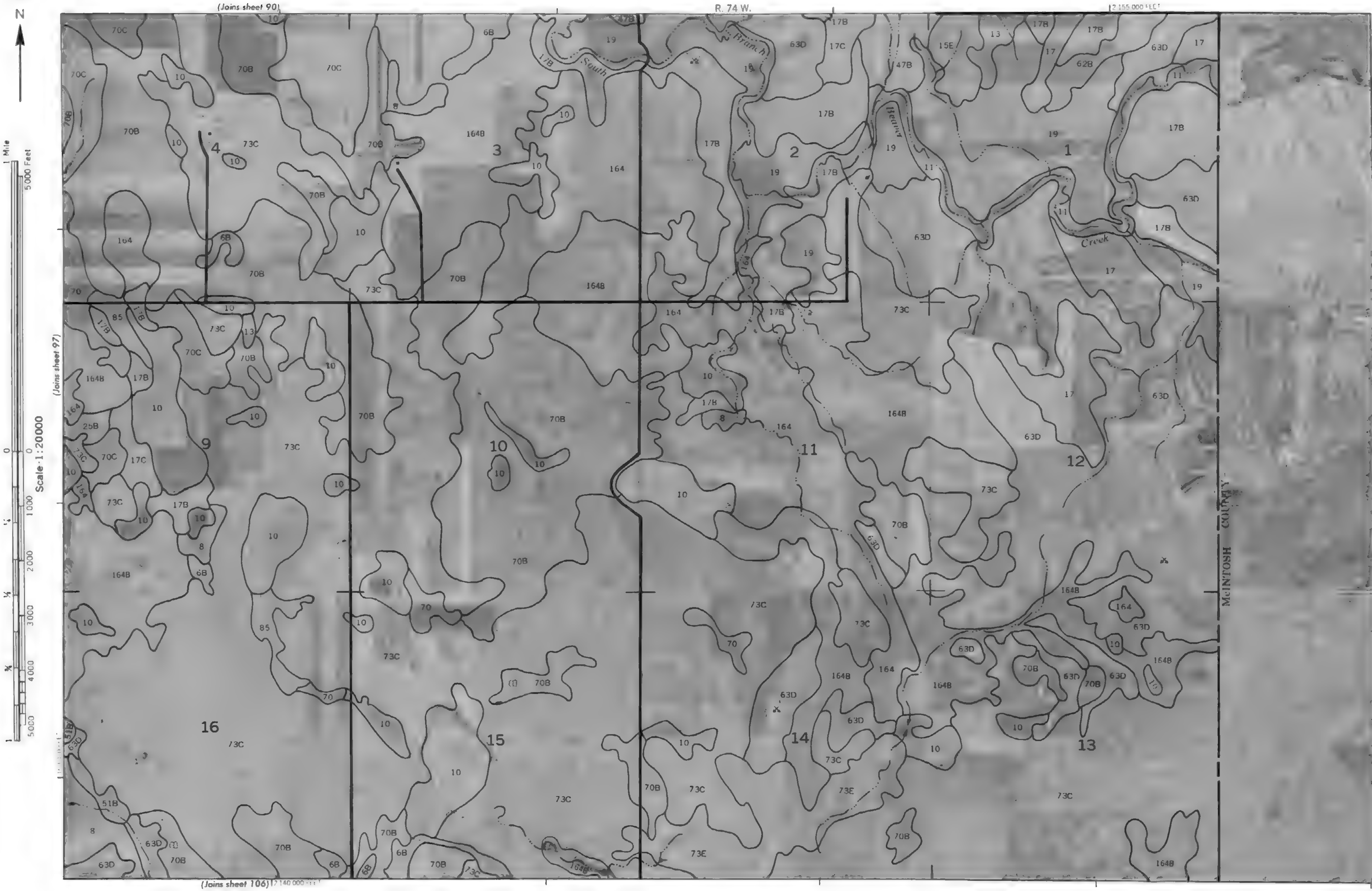

93
N
R. 78 W. | R. 77 W.
(Joins sheet 85)
(Joins sheet 92)
(Joins sheet 94)
(Joins sheet 101)
T. 130 N.
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000

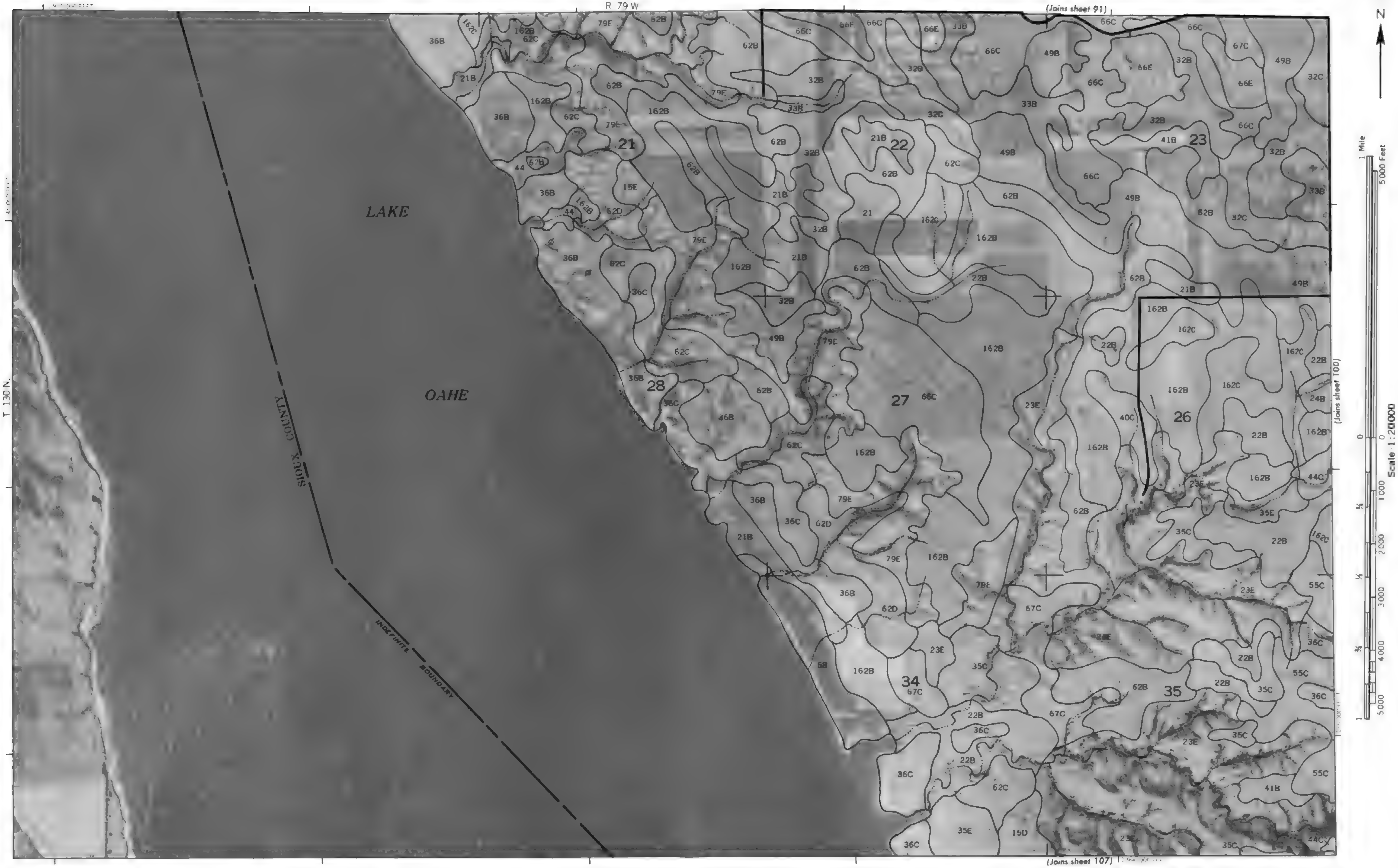

N
(Joins sheet 86)
R. 77 W.
R. 76 W.
(Joins sheet 93)
(Joins sheet 95)
(Joins sheet 102)
T. 130 N.
Scale 1:20000
1 Mile
5000 Feet
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18

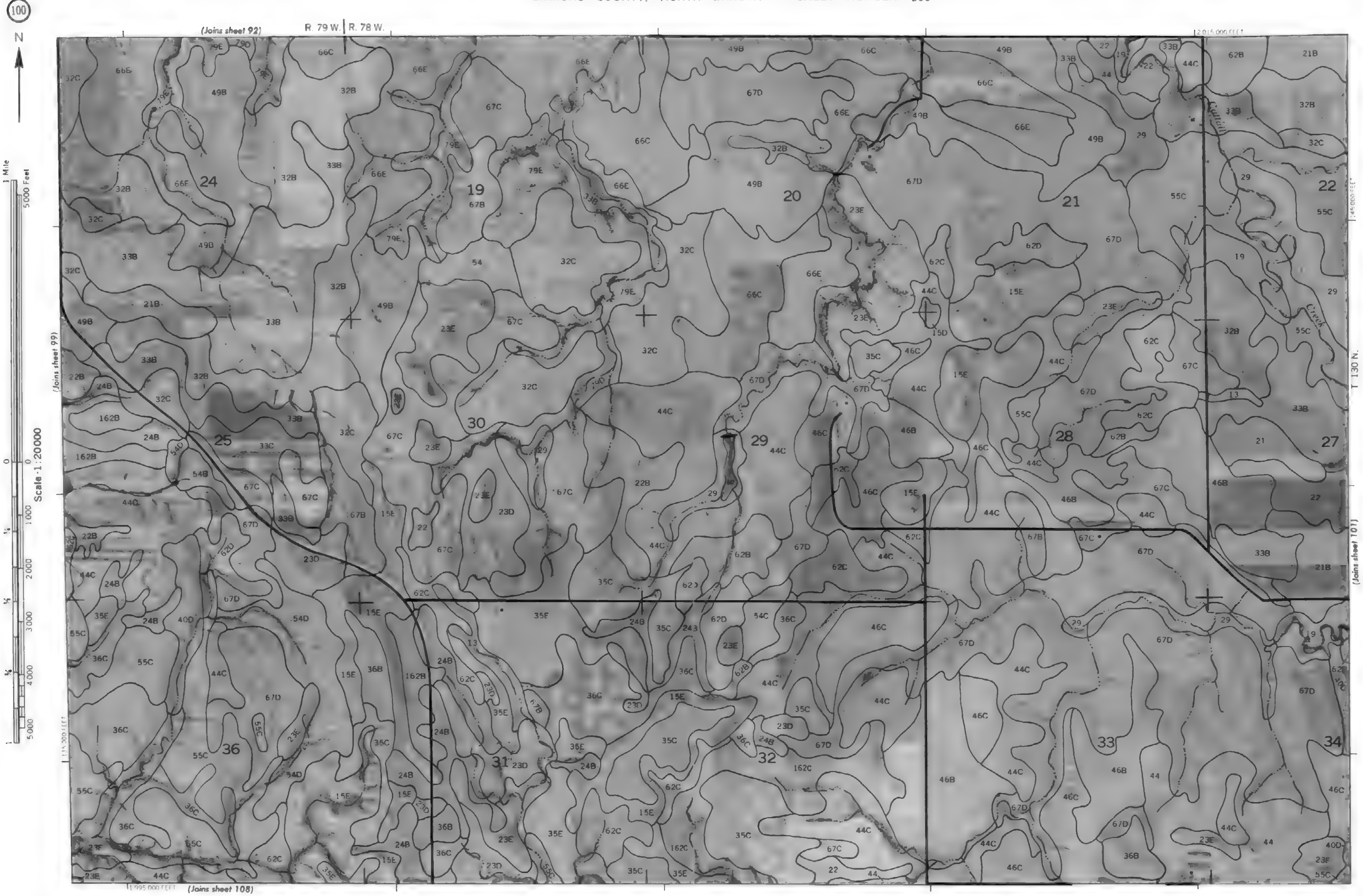

95
N
2 070 000 FEET
R. 76 W
(Joins sheet 87)
T. 130 N.
(Joins sheet 94)
(Joins sheet 96)
(Joins sheet 103)
2 085 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18

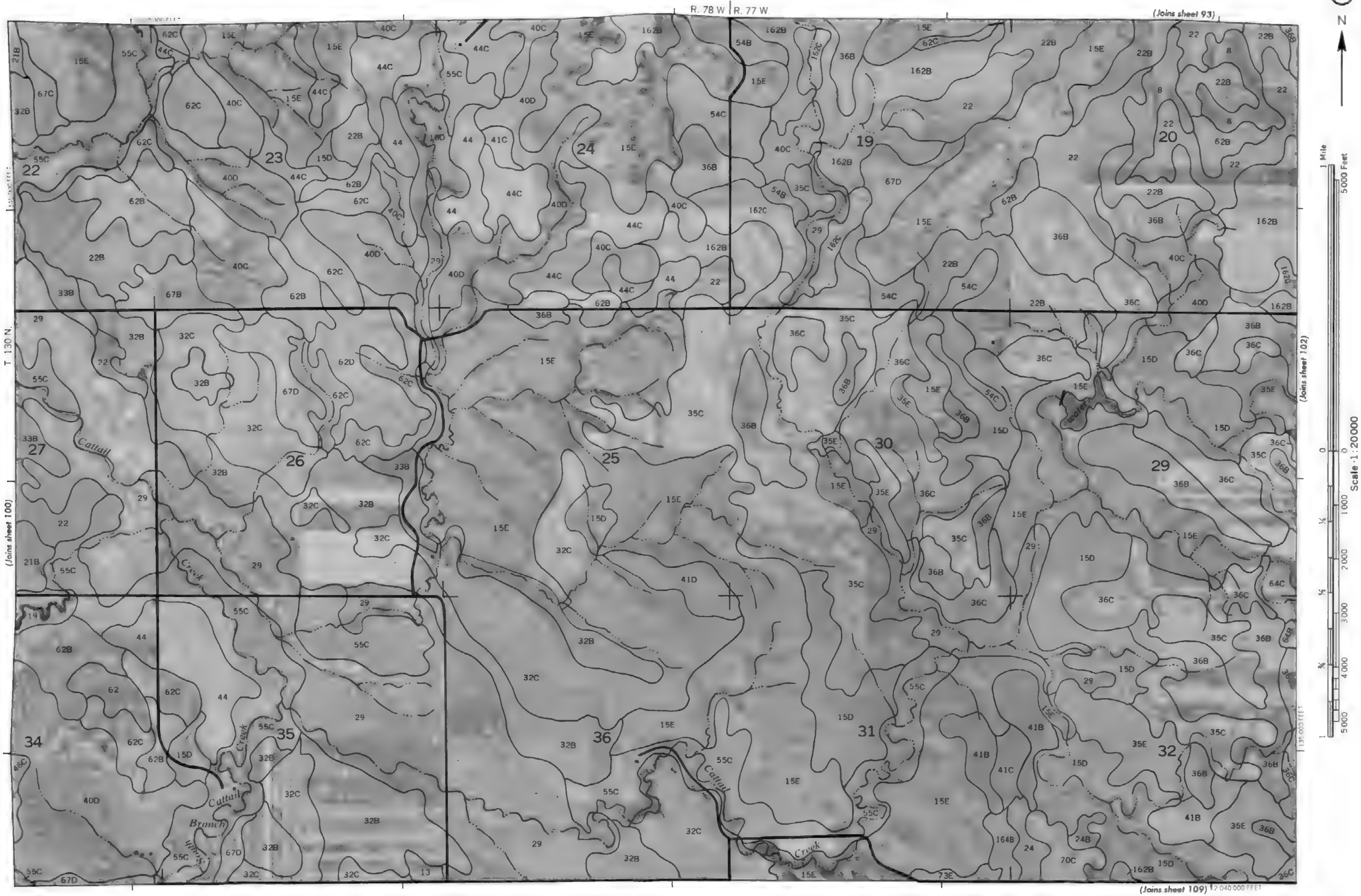

N
(Joins sheet 88)
R. 76 W.
R. 75 W.
(Joins sheet 95)
(Joins sheet 97)
(Joins sheet 104)
T. 130 N.
1 Mile
5000 Feet
Scale 1:20000
CHICAGO
MILWAUKEE
ST. PAUL
AND
PACIFIC
83
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18

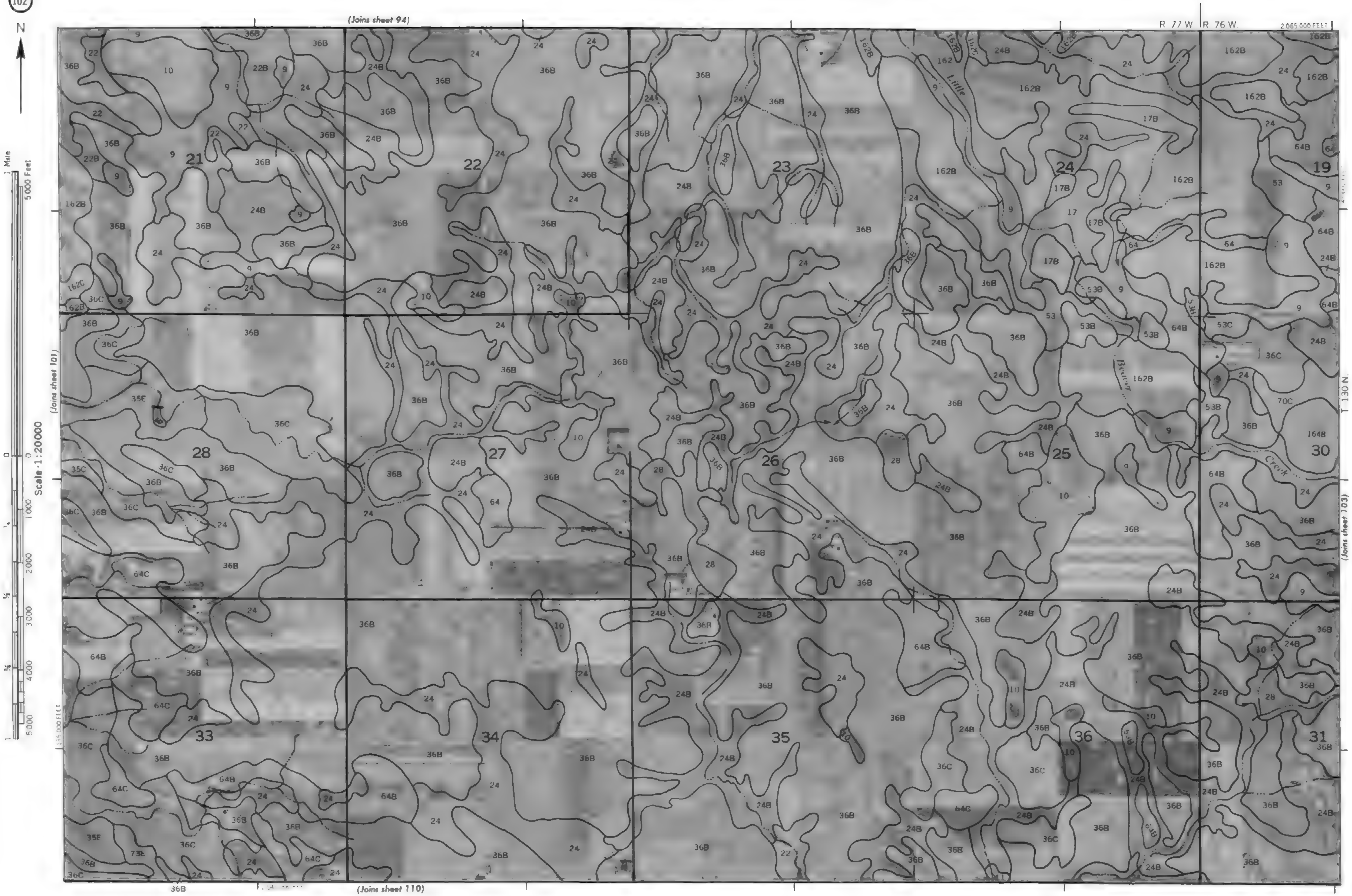

R. 75 W.
R. 74 W.
(Joins sheet 89)
(Joins sheet 98)
(Joins sheet 96)
(Joins sheet 105)
T. 130 N.
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000


N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 90)
R. 74 W.
2 155 000 FEET
(Joins sheet 97)
T. 130 N
McINTOSH COUNTY
(Joins sheet 106)
2 140 000 FEET
South Branch
Beaver
Creek

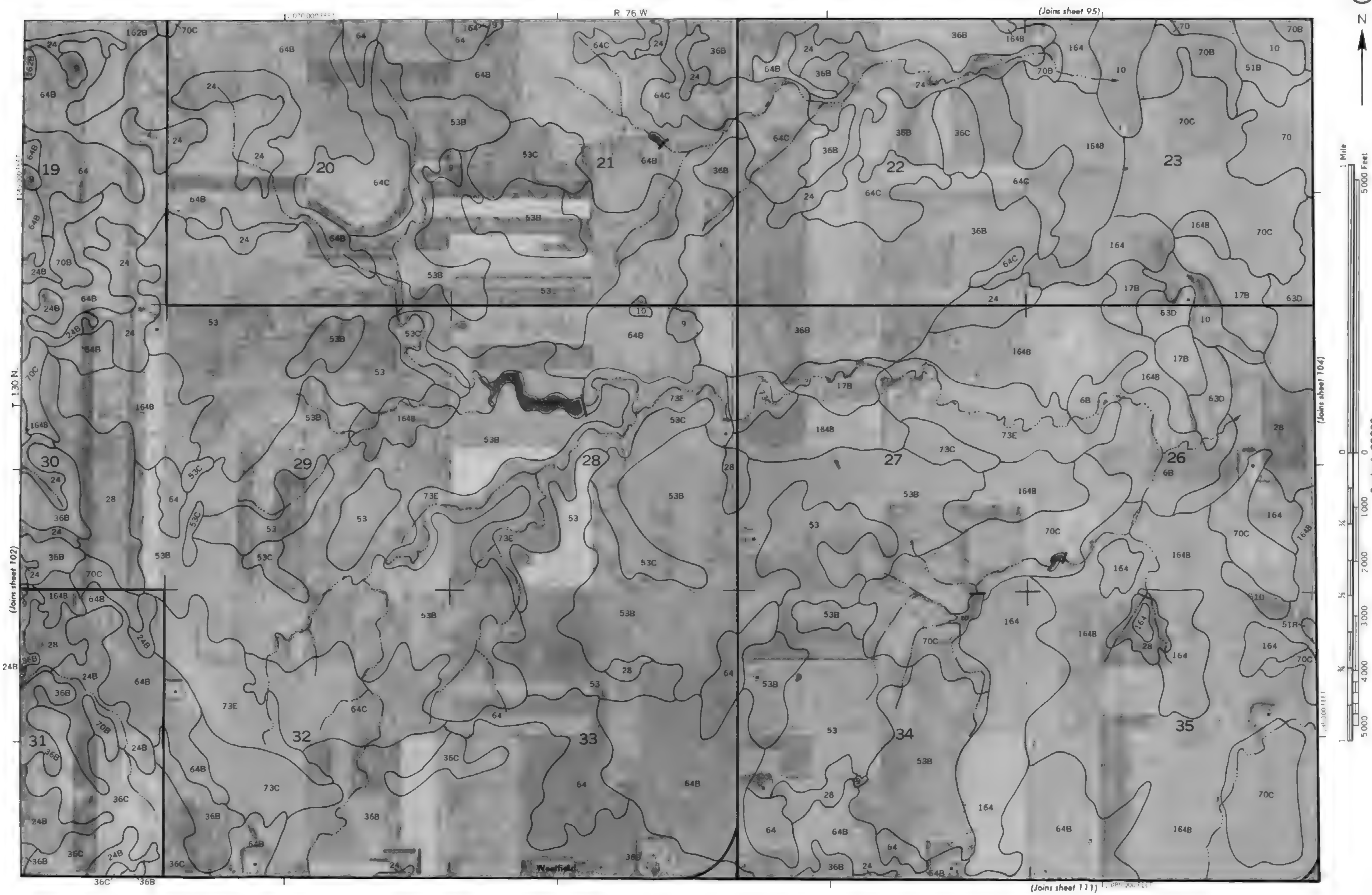

99
N
R. 79 W.
T. 130 N.
(Joins sheet 91)
(Joins sheet 100)
(Joins sheet 107)
LAKE
OAHE
SIOUX COUNTY
INDEFINITE BOUNDARY
21
22
23
26
27
28
34
35
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1

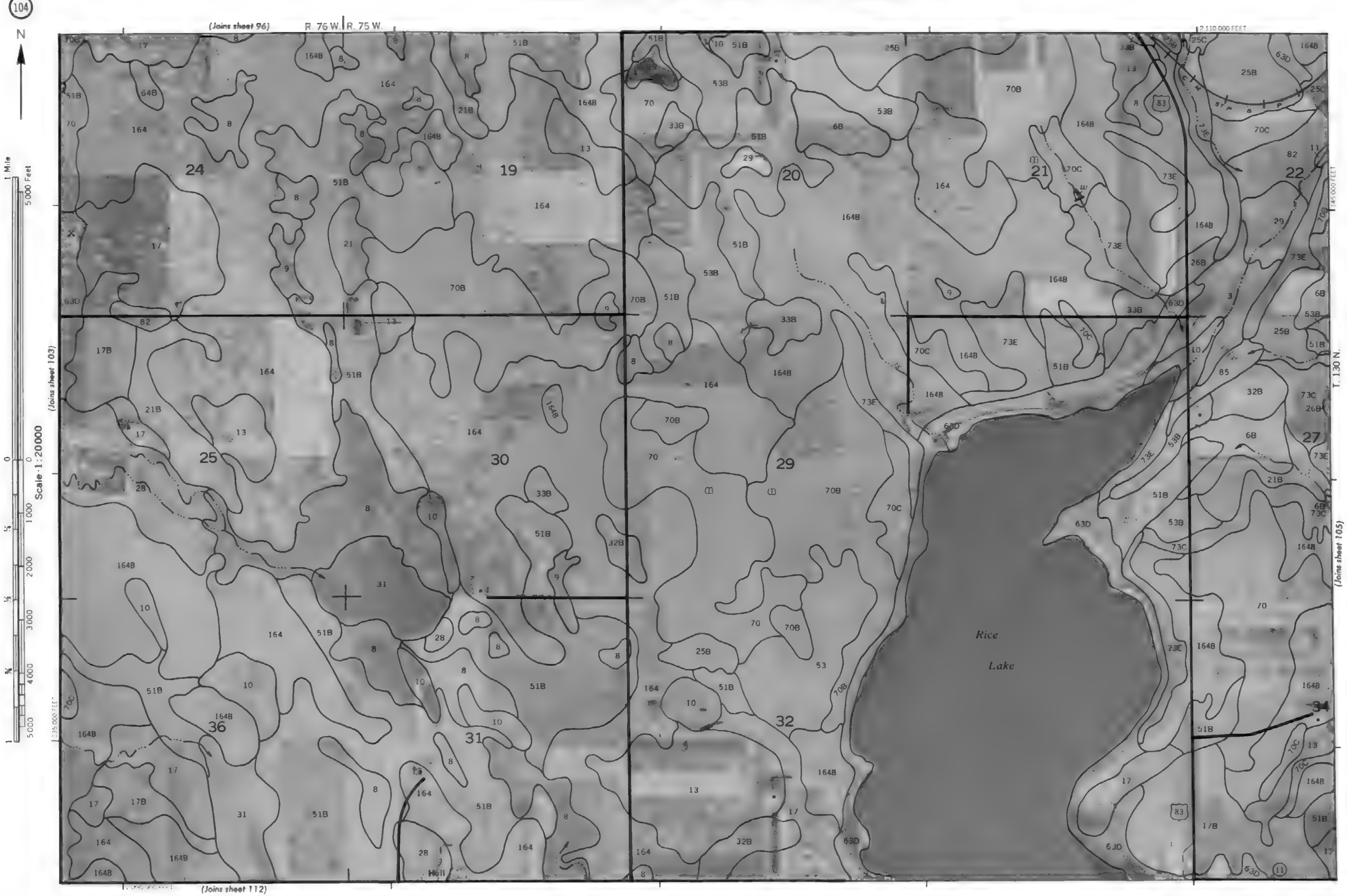

100
N
(Joins sheet 92)
R. 79 W. | R. 78 W.
(Joins sheet 99)
(Joins sheet 101)
(Joins sheet 108)
T. 130 N.
1 Mile
5000 Feet
Scale 1:20000
Cattail Creek
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36


101
N
R. 78 W.
R. 77 W.
(Joins sheet 93)
(Joins sheet 100)
(Joins sheet 102)
(Joins sheet 109)
T. 130 N.
Scale 1:20000
1 Mile
5000 Feet
Cattail
Creek
Cattail Branch
water

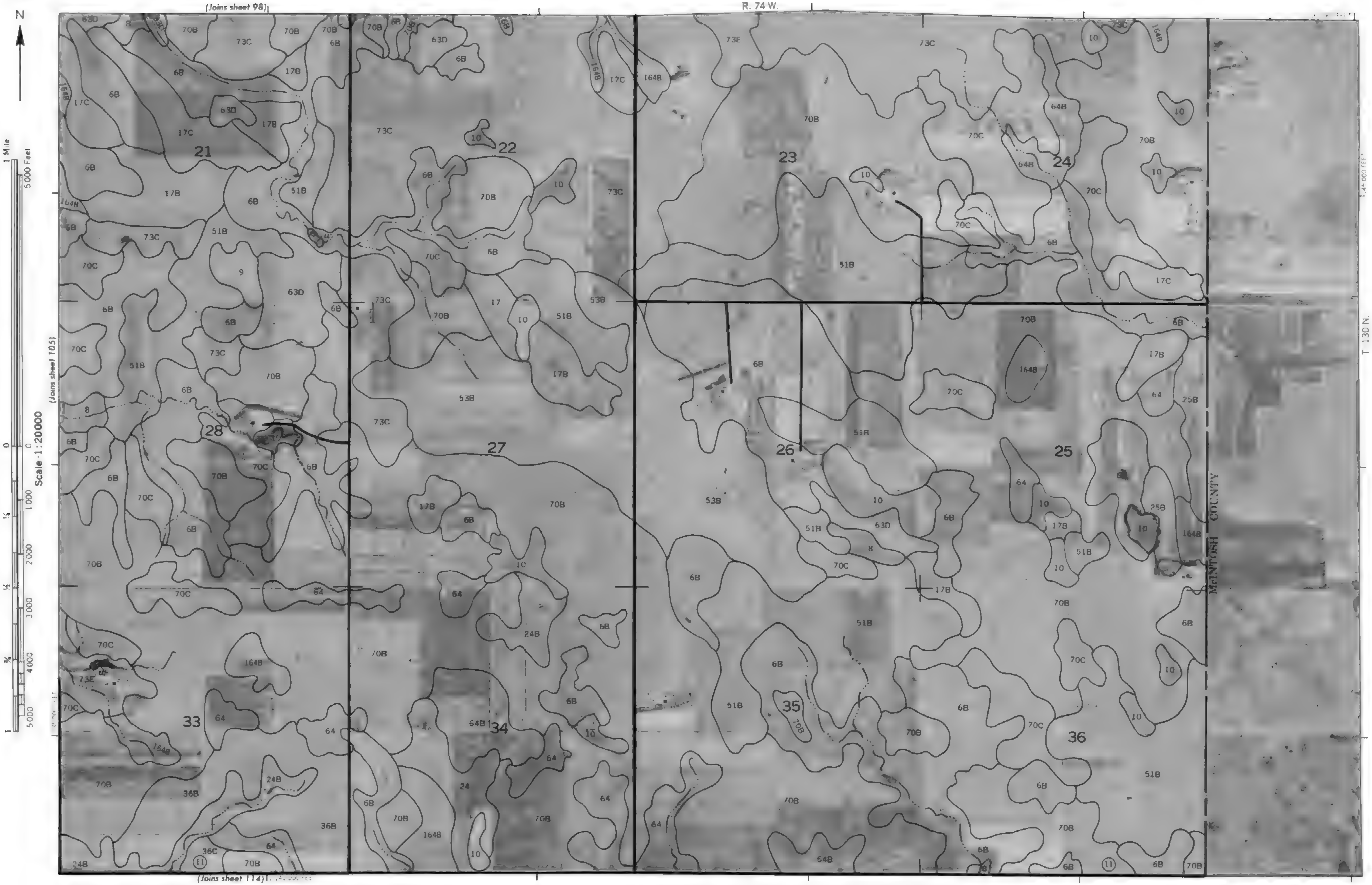

N
(Joins sheet 94)
(Joins sheet 101)
(Joins sheet 103)
(Joins sheet 110)
R. 77 W.
R. 76 W.
T. 130 N.
2 065 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
Little
Beaver
Creek

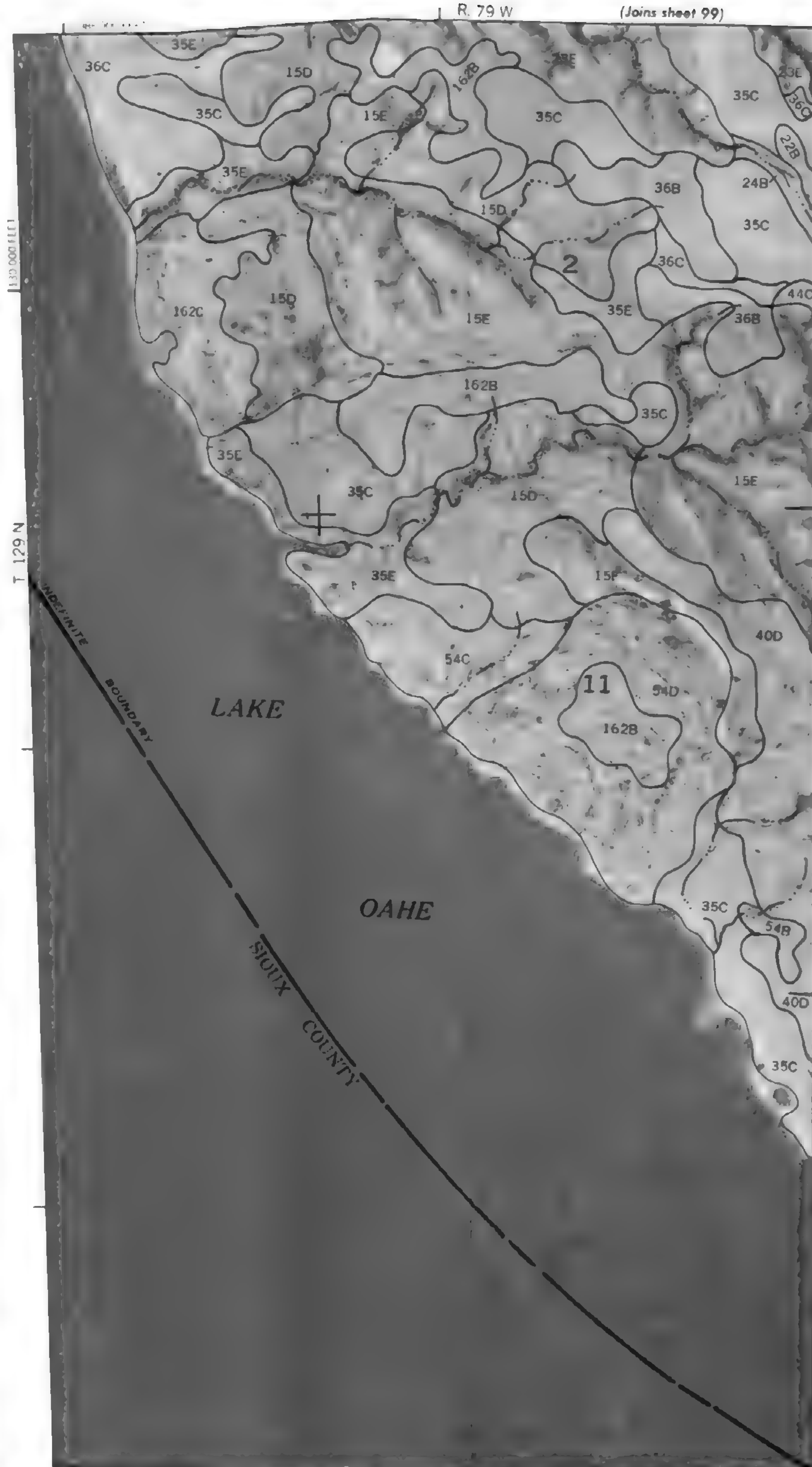
EMMONS COUNTY, NORTH DAKOTA — SHEET NUMBER 103




104
N
(Joins sheet 96)
R. 76 W. | R. 75 W.
(Joins sheet 103)
(Joins sheet 105)
(Joins sheet 112)
T. 130 N.
Scale 1:20000
1 Mile
5000 Feet
Rice
Lake
24
19
20
21
22
25
30
29
27
36
31
32
34

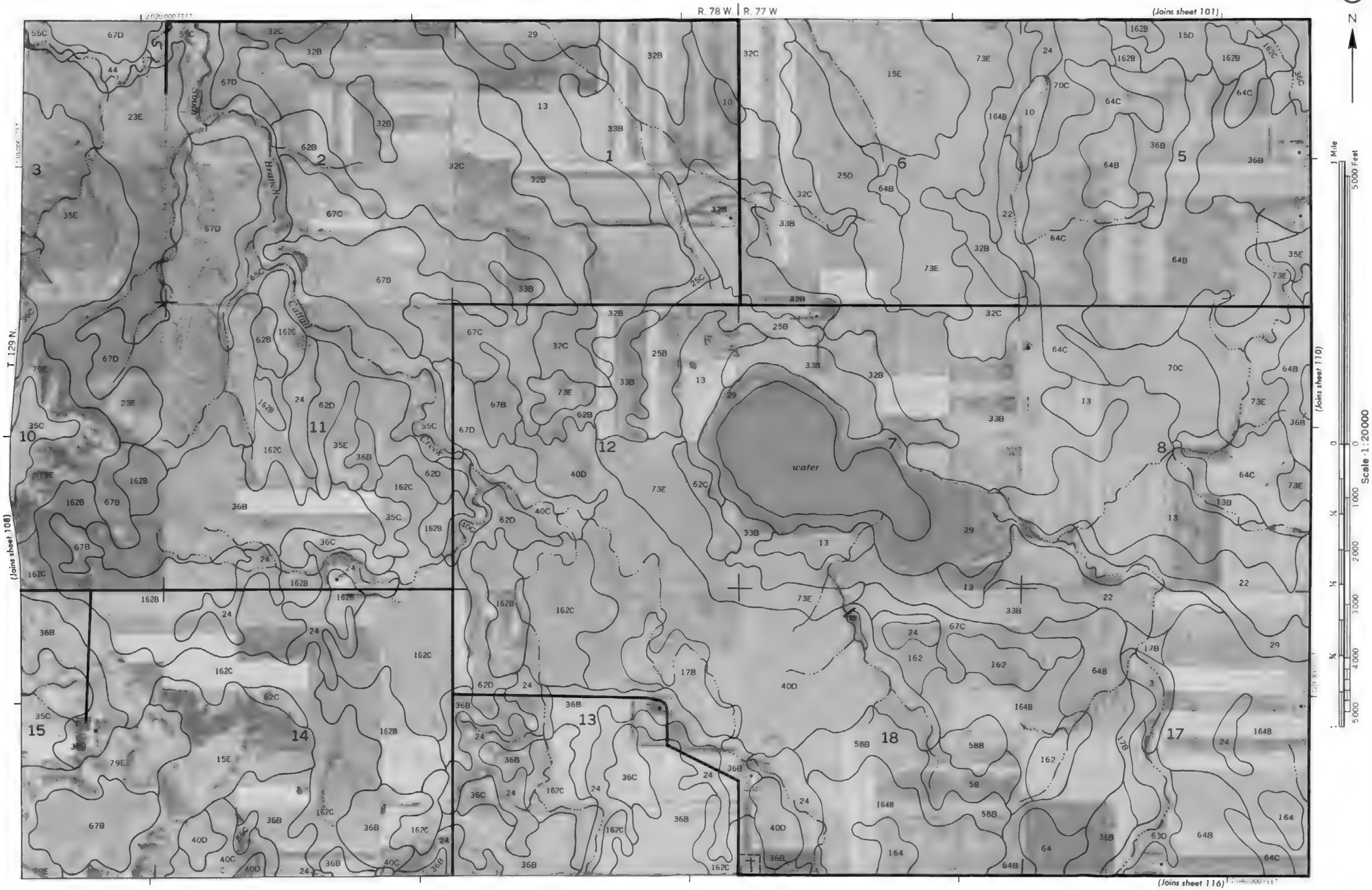

R. 75 W.
R. 74 W.
(Joins sheet 97)
(Joins sheet 104)
(Joins sheet 106)
(Joins sheet 113)
T. 130 N.
2 115 000 FEET
CHICAGO
MILWAUKEE
ST PAUL
AND
PACIFIC
Hague
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000

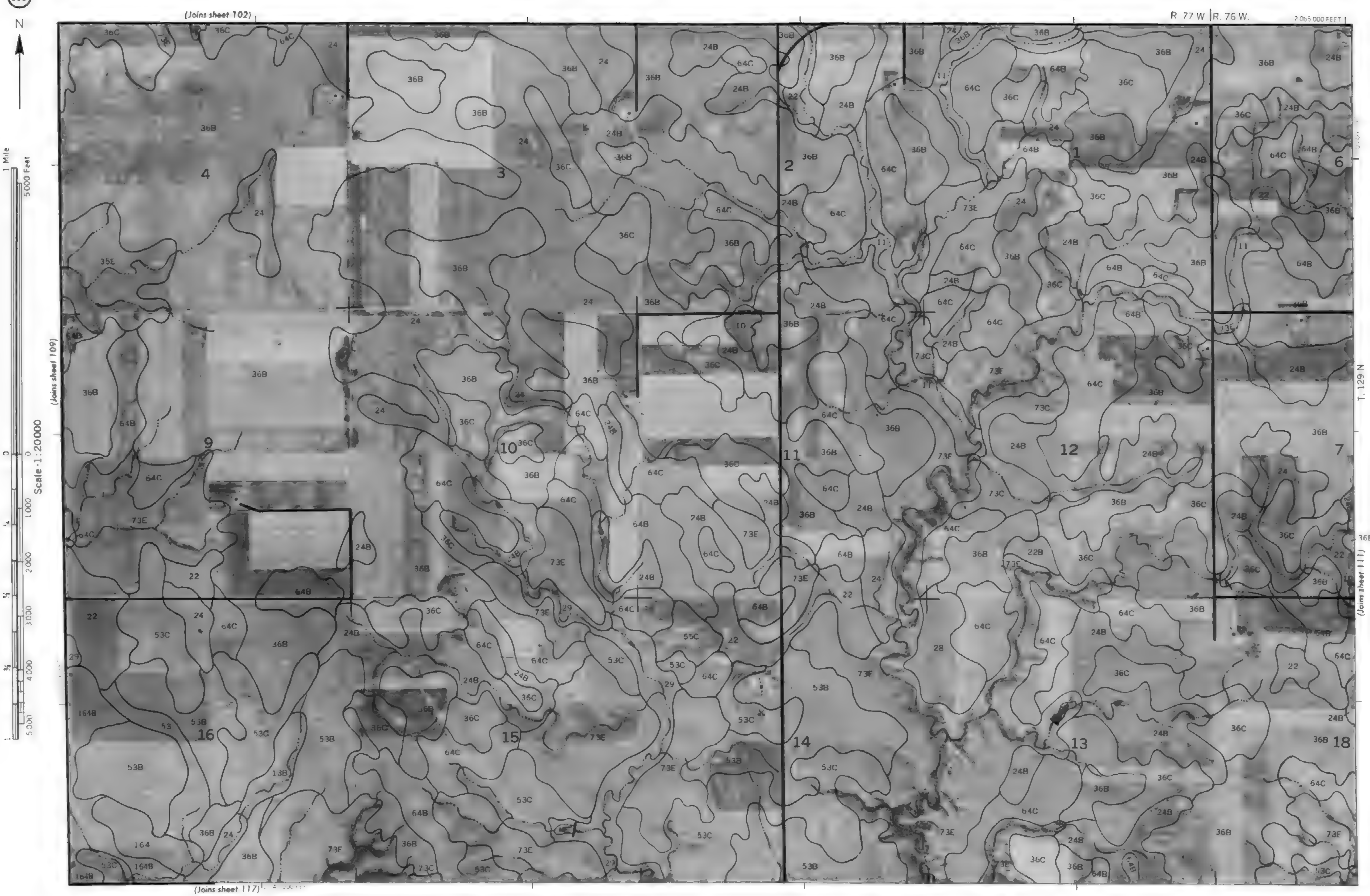

N
(Joins sheet 98)
R. 74 W.
T. 130 N.
(Joins sheet 105)
(Joins sheet 114)
McINTOSH COUNTY
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
21
22
23
24
25
26
27
28
33
34
35
36
11

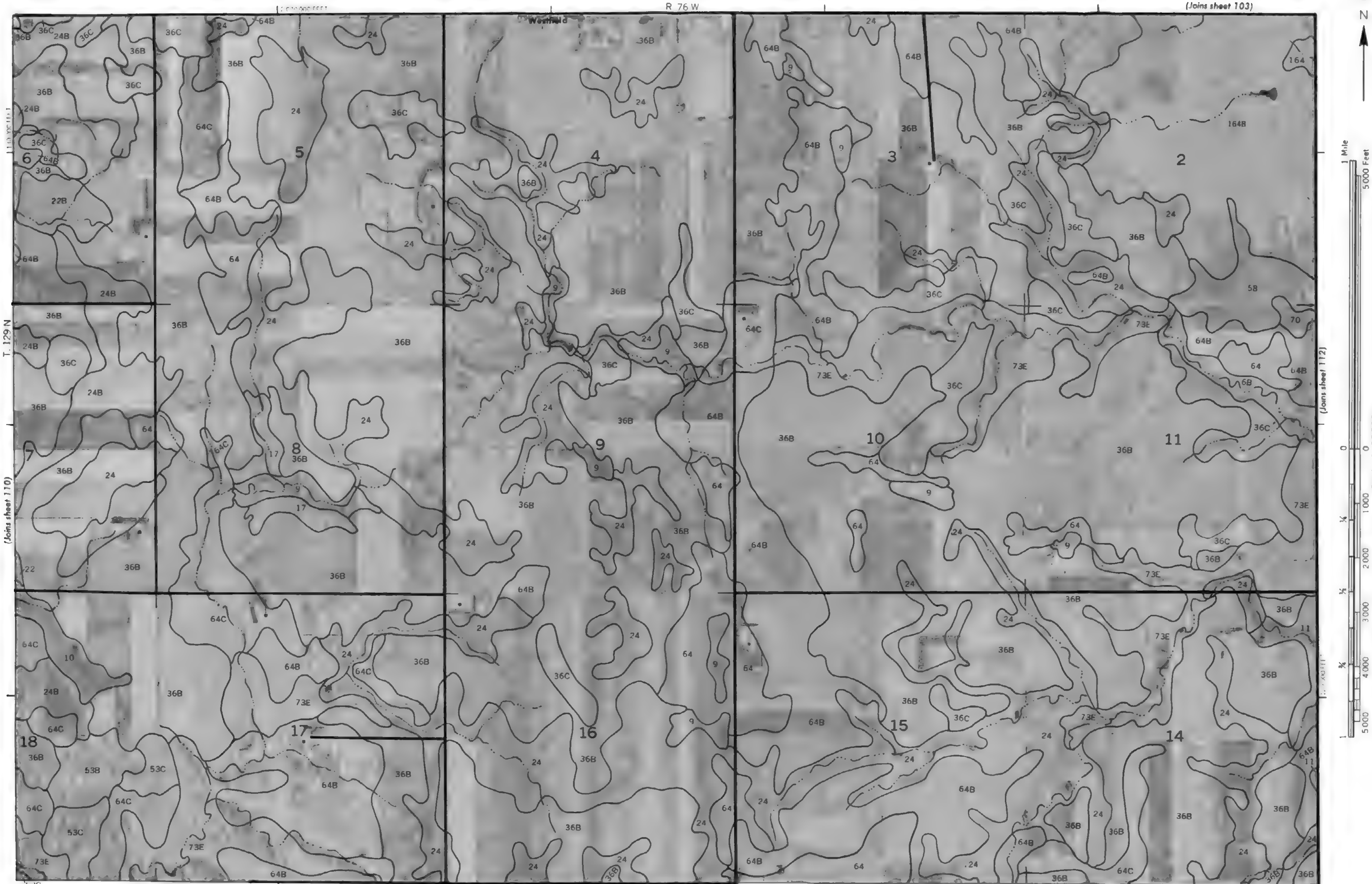


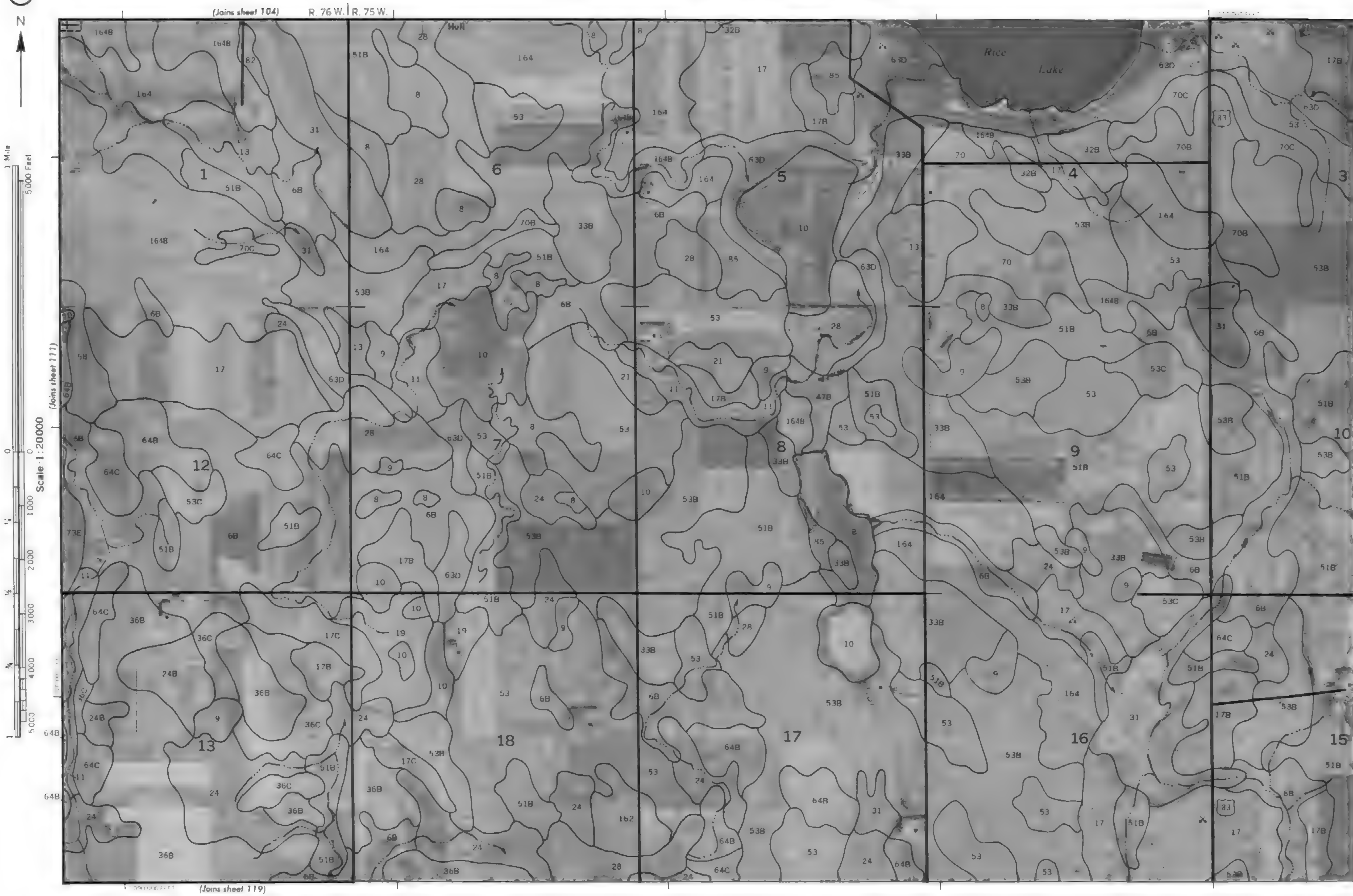
107
N
1 Mile
5000 Feet
Scale 1:20000

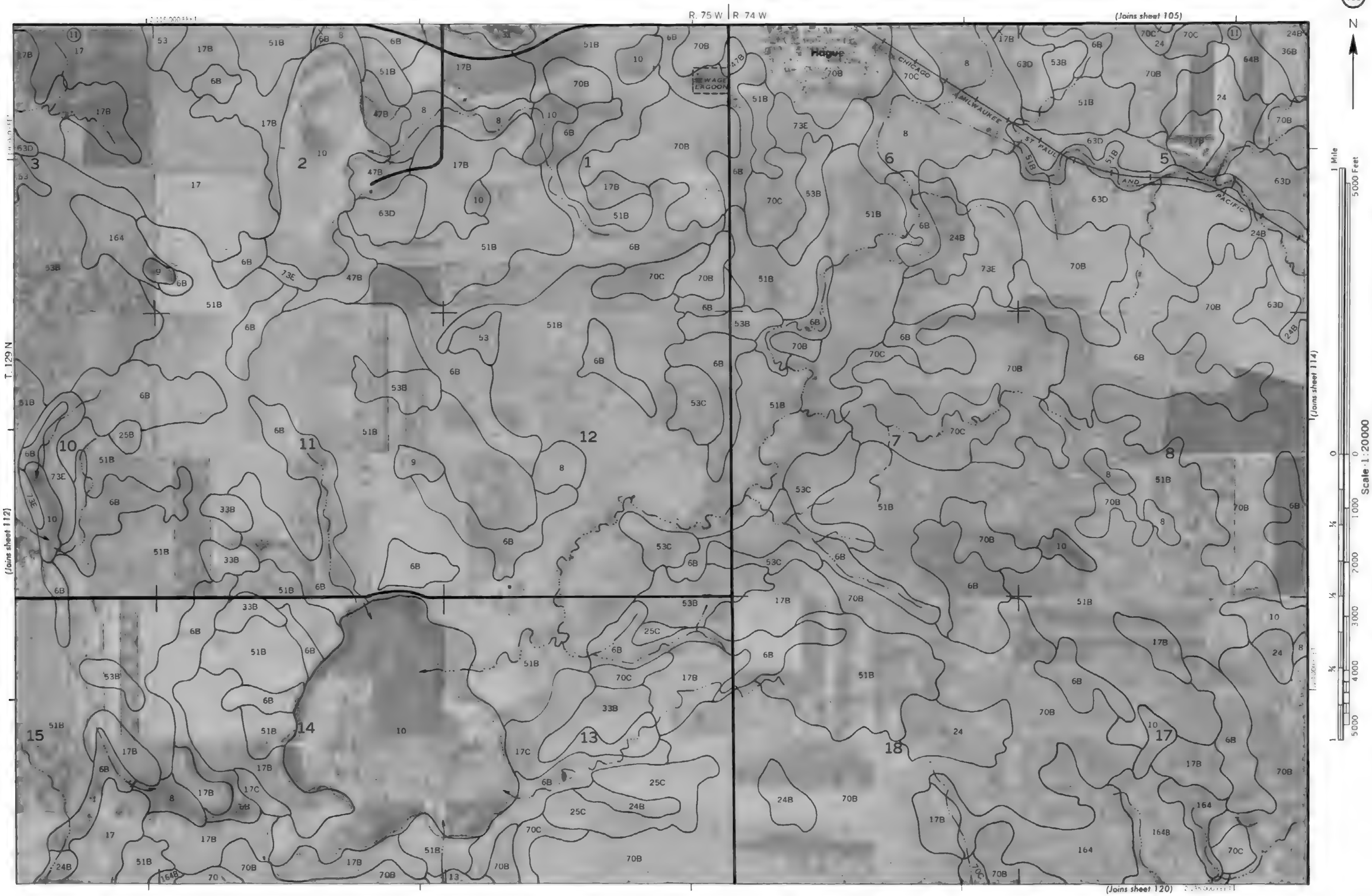
EMMONS COUNTY, NORTH DAKOTA — SHEET NUMBER 108


R. 78 W. | R. 77 W
(Joins sheet 101)
(Joins sheet 108)
(Joins sheet 110)
(Joins sheet 116)
T. 129 N.
N
Scale 1:20000
1 Mile
5000 Feet
water
South Branch
Cattail Creek

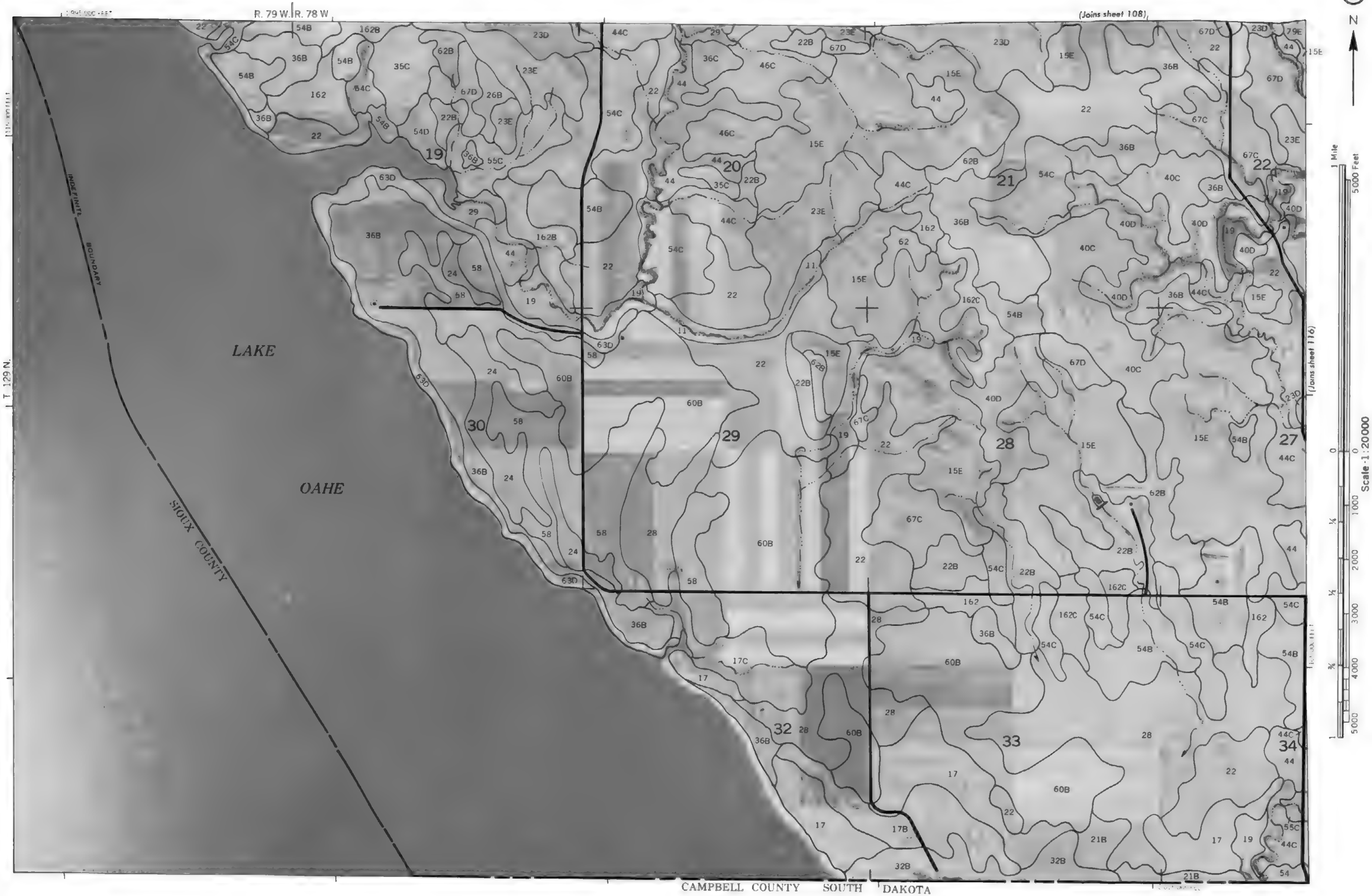

N
(Joins sheet 102)
R. 77 W.
R. 76 W.
(Joins sheet 109)
(Joins sheet 111)
(Joins sheet 117)
T. 129 N.
1 Mile
5000 Feet
Scale 1:20000
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18

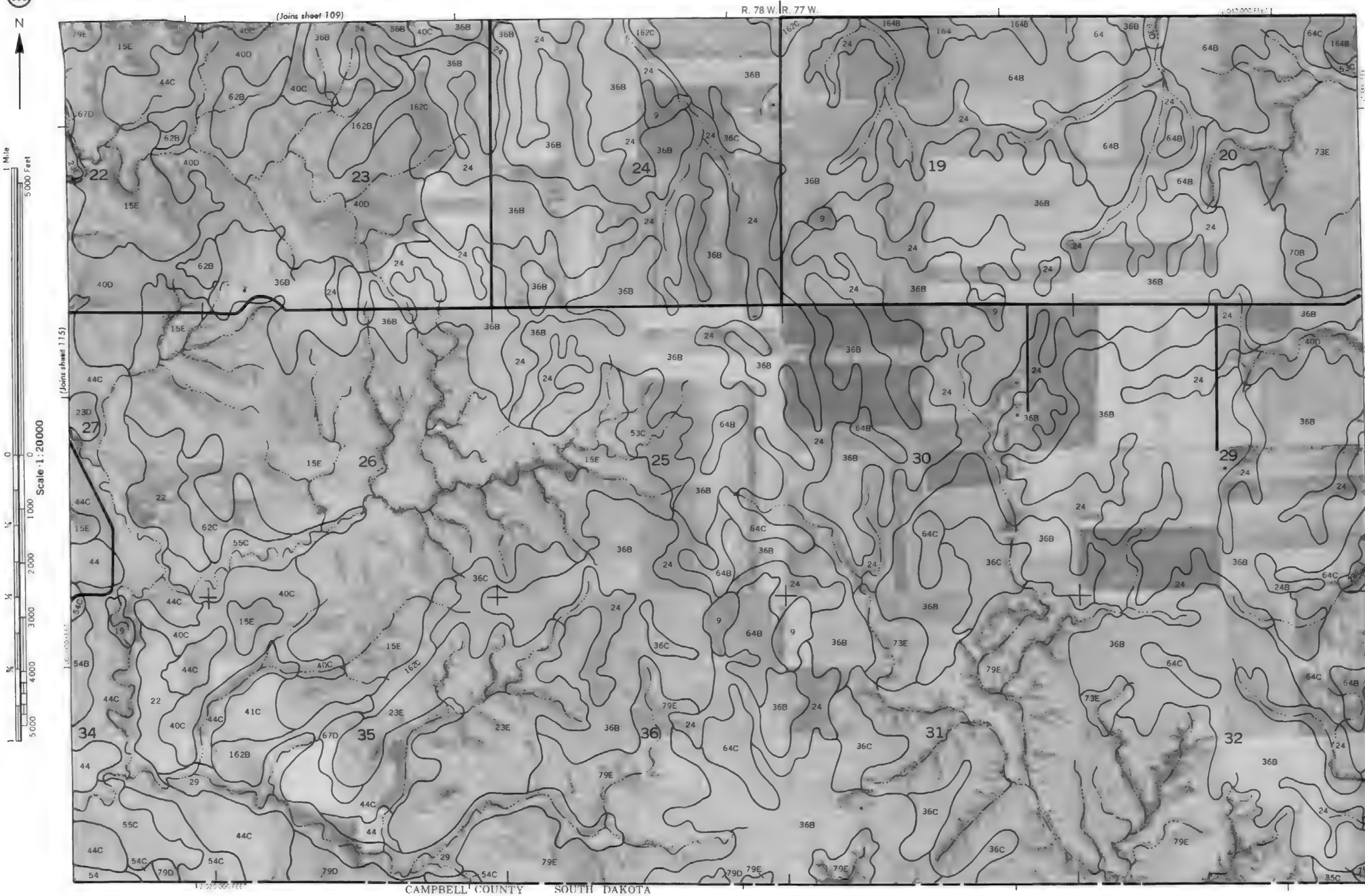

R. 76 W.
(Joins sheet 103)
(Joins sheet 110)
(Joins sheet 112)
(Joins sheet 118)
T. 129 N.
Westfield
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18


(Joins sheet 104)
R. 76 W. | R. 75 W.
N
Hull
Rice Lake
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 111)
(Joins sheet 113)
(Joins sheet 119)
T. 129 N.
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18


113
N
R. 75 W
R. 74 W
(Joins sheet 105)
(Joins sheet 114)
(Joins sheet 120)
(Joins sheet 112)
T. 129 N
Hague
SEWAGE LAGOON
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
1 Mile
5000 Feet
Scale 1:20000

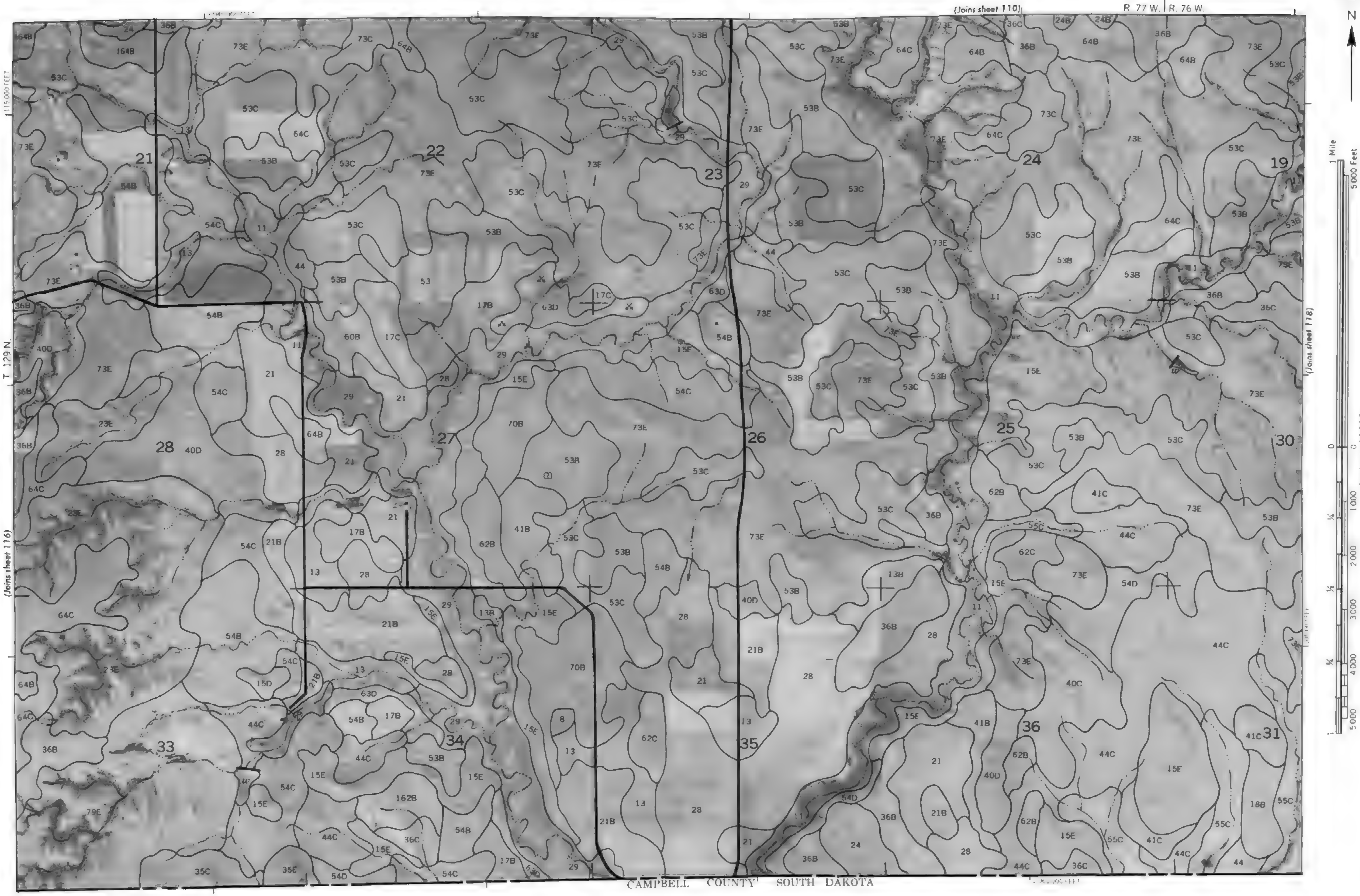

114
N
(Joins sheet 106)
R. 74 W.
2 160 000 FEET
(Joins sheet 113)
(Joins sheet 121)
2 140 000 FEET
T. 129 N.
McINTOSH COUNTY
CHICAGO
MILWAUKEE
ST PAUL
AND
PACIFIC
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
2
3
4
9
10
11
12
13
14
15
16

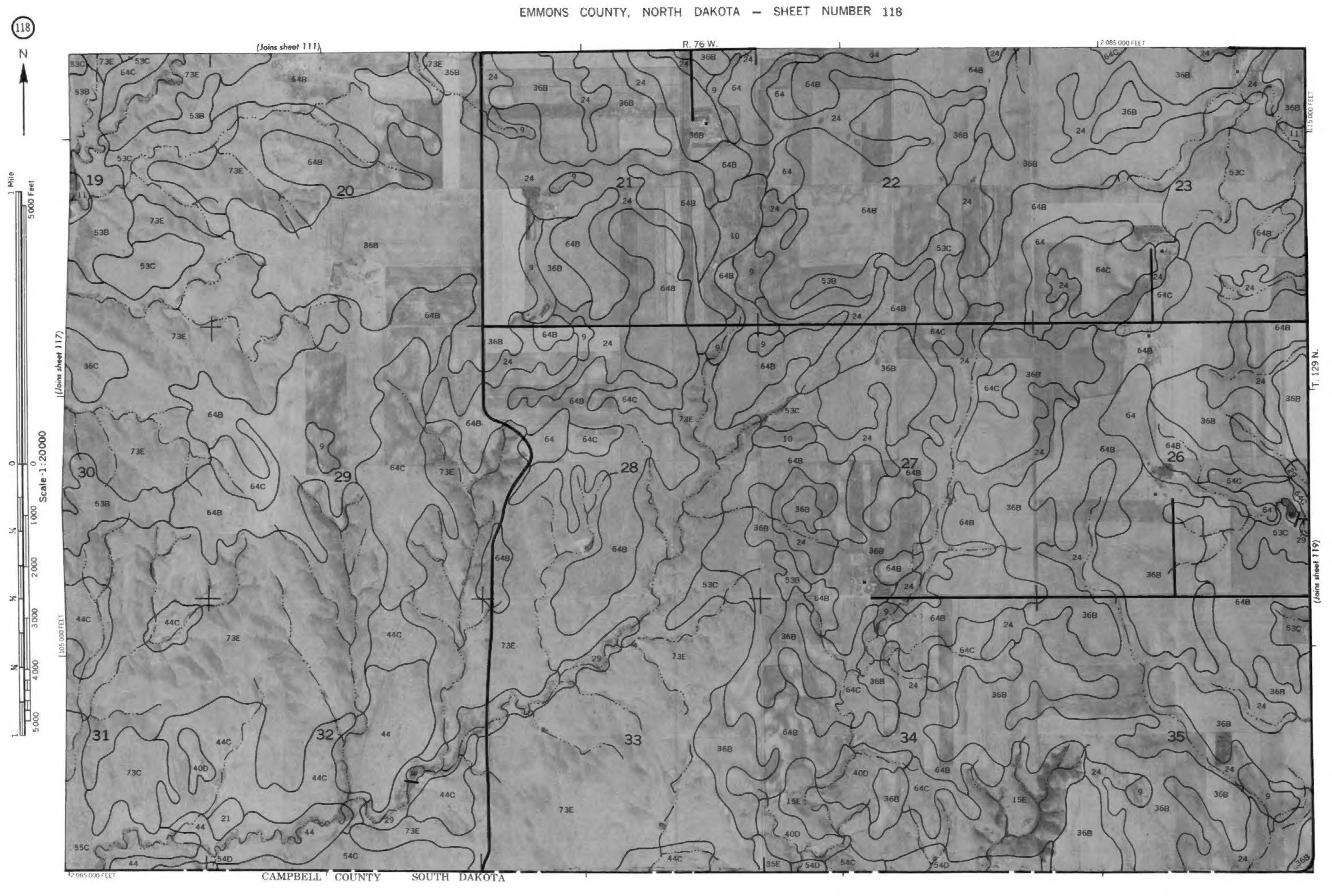

115
N
(Joins sheet 108)
(Joins sheet 116)
R. 79 W.
R. 78 W.
T. 129 N.
LAKE
OAHE
INDEFINITE BOUNDARY
SIOUX COUNTY
CAMPBELL COUNTY SOUTH DAKOTA
1 Mile
5000 Feet
Scale 1:20000
19
20
21
22
27
28
29
30
32
33
34


N
(Joins sheet 109)
R. 78 W.
R. 77 W.
T. 129 N.
(Joins sheet 115)
(Joins sheet 117)
1 Mile
5000 Feet
Scale 1:20000
CAMPBELL COUNTY
SOUTH DAKOTA
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36

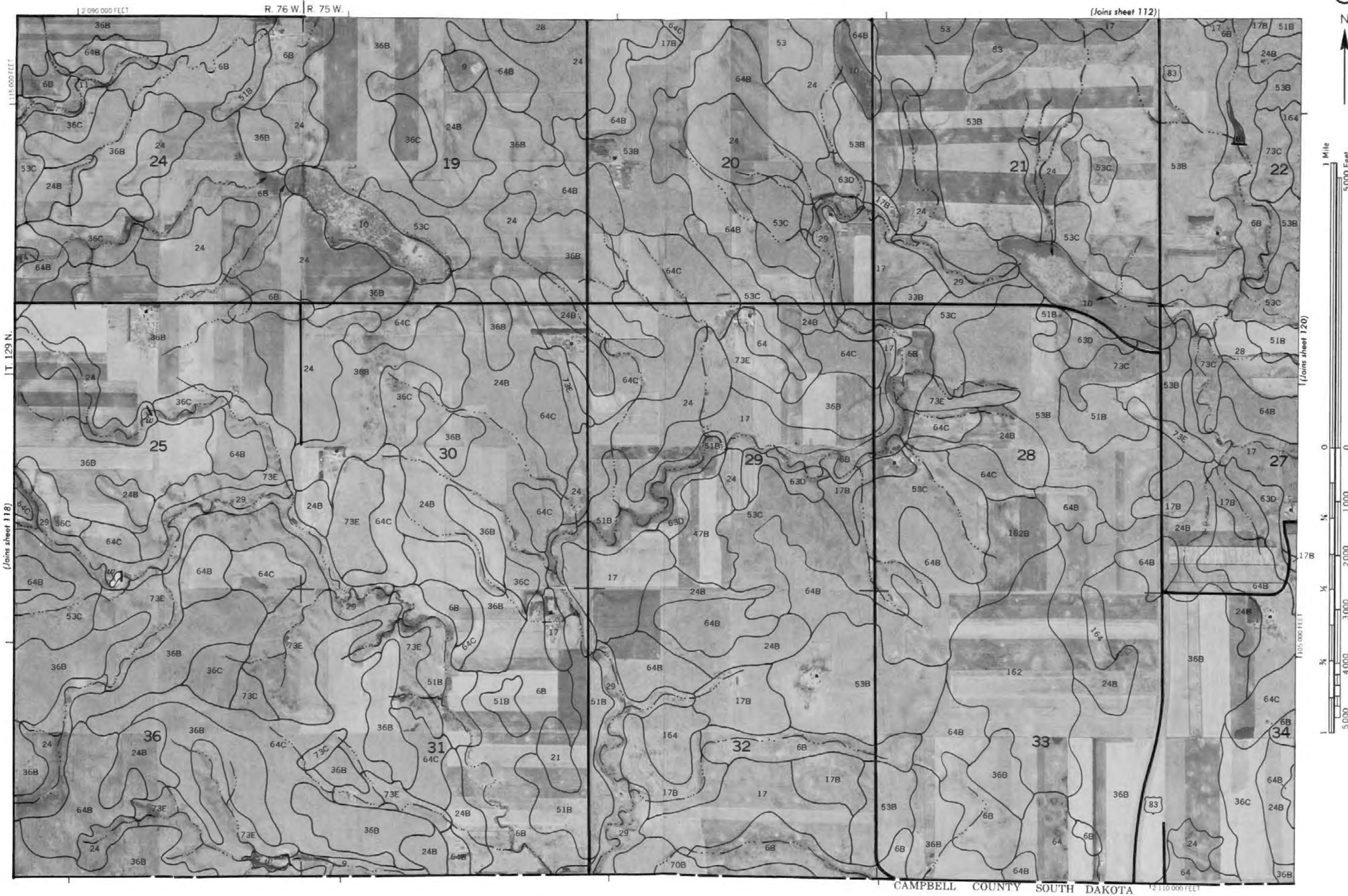
EMMONS COUNTY, NORTH DAKOTA — SHEET NUMBER 117

117

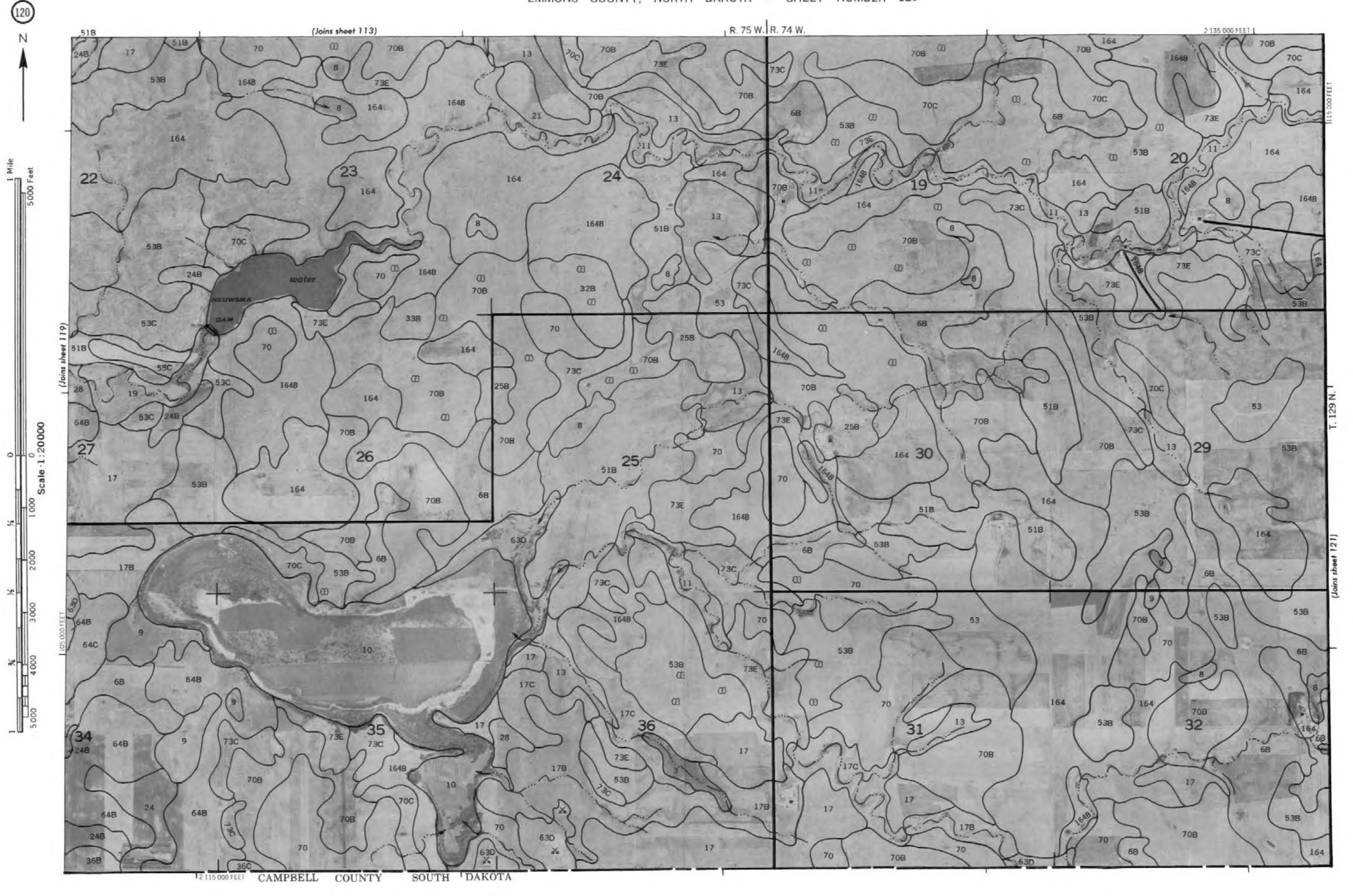


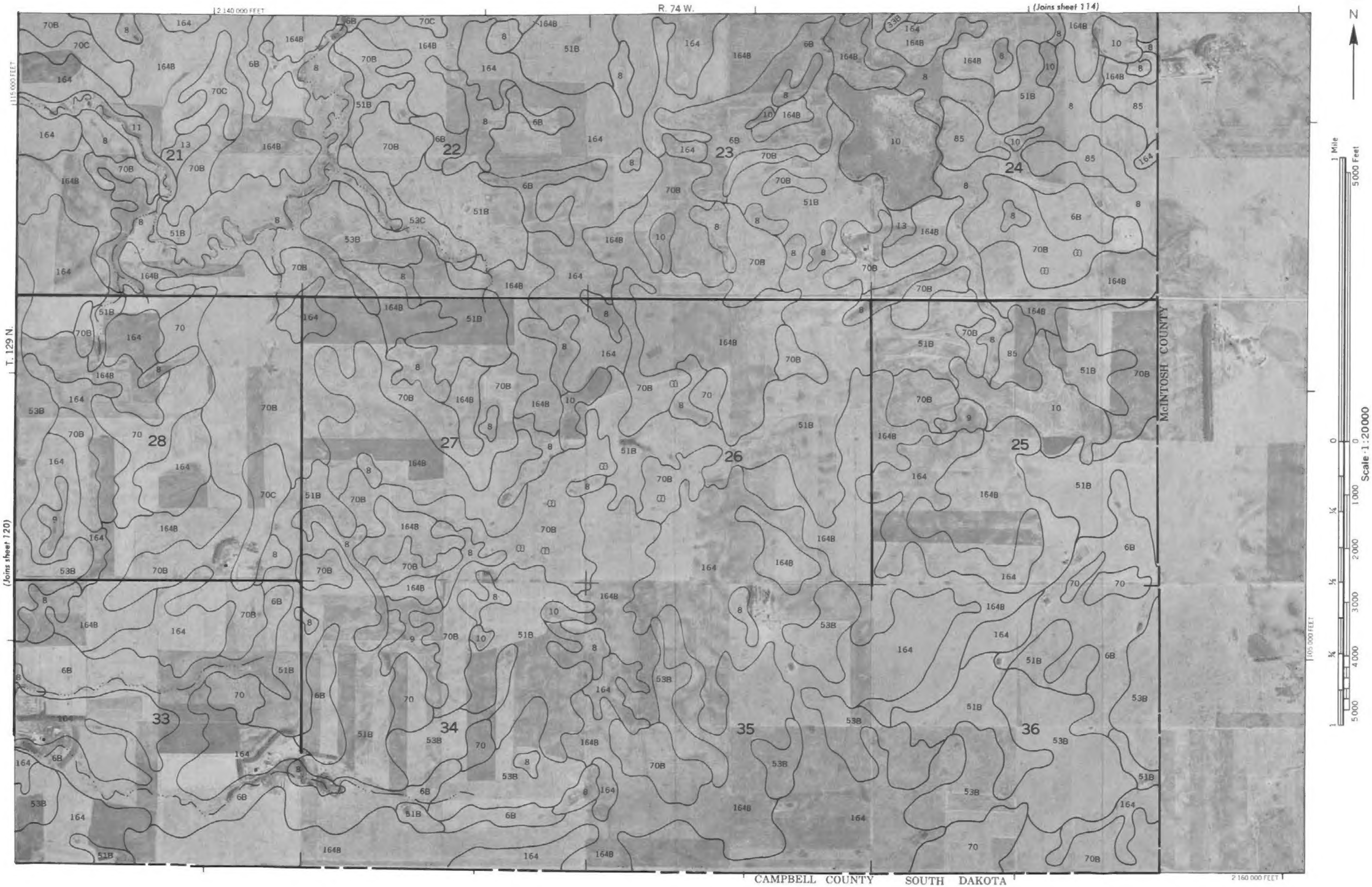

118
N
(Joins sheet 111)
R. 76 W.
2 085 000 FEET
(Joins sheet 117)
(Joins sheet 119)
T. 129 N.
1 Mile
5000 Feet
Scale 1:20000
105 000 FEET
2 065 000 FEET
CAMPBELL COUNTY SOUTH DAKOTA
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

119


2 090 000 FEET
R. 76 W.
R. 75 W.
(Joins sheet 112)
115 000 FEET
T. 129 N.
(Joins sheet 118)
(Joins sheet 120)
105 000 FEET
CAMPBELL COUNTY SOUTH DAKOTA
2 110 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
83

120


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 113)
R. 75 W.
R. 74 W.
2 135 000 FEET
115 000 FEET
(Joins sheet 119)
105 000 FEET
T. 129 N.
(Joins sheet 121)
2 115 000 FEET
CAMPBELL COUNTY SOUTH DAKOTA
NEUWSMA DAM
water
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32


121
N
2 140 000 FEET
R. 74 W.
(Joins sheet 114)
115 000 FEET
T. 129 N.
(Joins sheet 120)
McINTOSH COUNTY
CAMPBELL COUNTY
SOUTH DAKOTA
105 000 FEET
2 160 000 FEET
21
22
23
24
25
26
27
28
33
34
35
36
1 Mile
5000 Feet
Scale 1:20000